

DRAFT FINAL
REMEDIAL DESIGN REPORT
FOR
SITE 27
FORMER NAVAL AIR STATION MOFFETT FIELD,
SANTA CLARA COUNTY, CALIFORNIA

ENVIRONMENTAL MULTIPLE AWARD CONTRACT
Contract Number N68711-04-D-1105
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Prepared for



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ABBREVIATIONS AND ACRONYMS

°F	degrees Fahrenheit
ARAR	applicable or relevant and appropriate requirement
ARC	Ames Research Center
BCDC	Bay Conservation and Development Commission
bgs	below ground surface
BRAC	Base Realignment and Closure
Caltrans	California Department of Transportation
CANG	California Air National Guard
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
COPEC	chemical of potential ecological concern
CPR	Cardiopulmonary Resuscitation
CQC	Contractor Quality Control
CSC	California species of concern
CWA	Clean Water Act
DDT	dichlorodiphenyltrichloroethane
EMAC	Environmental Multiple Action Contract
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species
ESAL	equivalent single-axle loads
FS	Feasibility Study
F.S.	factor of safety
FWENC	Foster Wheeler Environmental Corporation
gpm	gallons per minute
HDPE	high-density polyethylene
HSA	hollow-stem auger
IPT West	Integrated Product Team
IRP	Installation Restoration Program

ABBREVIATIONS AND ACRONYMS

(Continued)

JARPA	Joint Aquatic Resource Permit Application
JMM	James M. Montgomery, Consulting Engineers, Inc.
LKD	lime kiln dust
LTA	lighter-than-air
MBTA	Migratory Bird Treaty Act
mg/kg	milligrams per kilogram
msl	mean sea level
MW	Montgomery Watson
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NAVFAC SW	Naval Facilities Engineering Command, Southwest
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFEC SW	Naval Facilities Engineering Command Southwest
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRP	NASA Research Park
NWP 38	Nationwide Permit 38
PCB	polychlorinated biphenyl
PE	Professional Engineer
PESM	Project Environmental and Safety Manager
PjM	Project Manager
PMO	Program Management Office
POTW	publicly owned treatment works
PPE	personal protective equipment
PQCM	Project Quality Control Manager
PRC	PRC Environmental Management, Inc.
psf	pounds per square feet
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control

ABBREVIATIONS AND ACRONYMS

(Continued)

RAB	Restoration Advisory Board
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RHA	Rivers and Harbors Act
RI	Remedial Investigation
ROD	Record of Decision
ROICC	Resident Officer in Charge of Construction
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SHSP	Site-Specific Health and Safety Plan
SHSS	Site Health and Safety Specialist
STLC	Soluble Threshold Limit Concentration
SWEA	Site-Wide Ecological Assessment
SWMP	Stormwater Management Plan
TCLP	Toxicity Characteristic Leaching Procedure
TDP	Transportation and Disposal Plan
TN&A	T N & Associates, Inc.
TtEC	Tetra Tech EC, Inc.
TtEMI	Tetra Tech EM, Inc.
TTLC	Total Threshold Limit Concentration
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WB	California Water Board
WLPM	waste lock polymer material

EXECUTIVE SUMMARY

The Remedial Design Report presents the pre-design data collected and remedial design developed for the selected remedy for Site 27, located at the former Naval Air Station (NAS) Moffett Field (Moffett) in Mountain View, California. The Navy has conducted a Feasibility Study to evaluate the potential remedial alternatives for Site 27 and prepared a Record of Decision (ROD) (Naval Facilities Engineering Command, Southwest [NFCSW], 2005) to document the selected remedy for the site. The selected remedy identified in the Northern Channel ROD (NFECWS, 2005) (Site 27) (Tetra Tech EM, Inc., 2003) is the excavation of contaminated sediment in the Northern Channel, Marriage Road Ditch and North Patrol Road Ditch, contaminated soil in one portion of the Northern Channel berm, and the debris pile above the Remedial Action Objectives (RAOs). Approximately 65,000 cubic yards of contaminated sediment, soil and debris are anticipated and are to be disposed off site in Class I and Class II landfills.

Historical stormwater runoff and discharges from Moffett have impacted the sediment within the Northern Channel and the associated ditches with the accumulation of polychlorinated biphenyls (PCBs), pesticides and metals. The debris pile, located at the west end of the Northern Channel, consists of possibly excavated sediments from the Northern Channel, construction debris, and riprap such as broken concrete, asphalt, and other debris left from the 1950s that may have been used to stabilize and prevent erosion of the berm on the west end of the Northern Channel.

Pre-design field activities were conducted from May 11 through June 8, 2005, to gather necessary data in order to develop the remedial design for Site 27. These activities included surveying, collecting soil samples for geotechnical testing, and collecting sediment samples for geotechnical and bench-scale testing. A topographic survey was conducted to document existing conditions of the Northern Channel, North Patrol Road Ditch, Marriage Road Ditch, and the debris pile area and included adjacent embankments, berm, and areas contributing surface water run-on into Site 27. This survey data was used in conjunction with rainfall data and additional site-related hydrology data to perform hydrology and hydraulics calculations necessary to support the remedial design.

Geotechnical testing was conducted along the Northern Channel berm and samples were analyzed for soil shear strength, soil density, and moisture content. The results of the geotechnical tests were used to perform a slope stability analysis for the Northern Channel bank to evaluate the extent of impact of trucks hauling excavated sediment will have on the existing slopes. It was determined that a haul truck, with a surcharge loading of 3,326 pounds per square feet (psf), would have an adequate factor of safety (F.S.) of 1.8 (a F.S. of 1.2 is considered satisfactory during construction activities).

Sediment samples were collected along the bottom of the Northern Channel for use in a bench-scale test to determine the type and quantity of reagent necessary to meet the water content requirement of the disposal facility. The objective of the bench-scale testing was to determine which reagent is best suited for solidifying the sediment after it has been excavated. Different reagents (waste lock polymer material [WLPM] or lime kiln dust [LKD]) at various percents per dry weight were mixed in order to determine the most efficient combination to solidify the sediments. The reagent/mixing ratio of WLPM at 0.6 to 1.0 percent was selected for implementation during remedial activities.

The remedial design includes design drawings, specifications and associated project-specific plans necessary to implement the selected remedial action for Site 27. Project-specific plans are provided in the appendices and include Transportation and Disposal Plan, Stormwater Management Plan, Sampling and Analysis Plan, and a Data Management Plan.

1.0 INTRODUCTION

The Remedial Design Report describes the pre-design data collected and remedial design developed to implement the remedy selected for Site 27, located at the former Naval Air Station (NAS) Moffett Field (Moffett) in Mountain View, California (Figure 1-1). The Naval Facilities Engineering Command, Southwest (NAVFAC SW) has authorized the TN & Associates (TN&A)/Tetra Tech EC, Inc. (TtEC) team to prepare this report and perform the associated pre-design field activities under Environmental Multiple Action Contract (EMAC) No. N68711-04-D-1105. Regulatory oversight and guidance for the remedial design will be provided by the U.S. Environmental Protection Agency (EPA) and the California Water Board (WB), San Francisco Bay Region.

Site 27 consists of the Northern Channel, the berms adjacent to the Northern Channel, and three associated ditches that discharge into the Northern Channel: Marriage Road Ditch, Patrol Road Ditch, and North Patrol Road Ditch (Figure 1-2). The three ditches range from 2,000 to 4,000 feet in length. The Northern Channel is approximately 10,000 feet long and runs along the northeast boundary of Moffett and then extends past the boundary to the east. Historical stormwater runoff and discharges from Moffett have impacted the sediment within the Northern Channel and the associated ditches with the accumulation of polychlorinated biphenyls (PCBs), pesticides and metals. The site also includes a contaminated debris pile located at the west end of the Northern Channel. The pile consists of possibly excavated sediments from the Northern Channel, construction debris, and riprap such as broken concrete, asphalt, and other debris left from the 1950s that may have been used to stabilize and prevent erosion of the berm on the west end of the Northern Channel.

The Northern Channel Feasibility Study (FS) (Site 27) (Tetra Tech EM, Inc. [TtEMI], 2003) evaluated remedial alternatives to reduce the potential for ecological and human exposure to the chemicals of potential ecological concern (COPECs) at Site 27. The selected alternative identified in the Record of Decision (ROD) (Base Realignment and Closure [BRAC] Program Management Office [PMO] West, 2005) is the excavation of the contaminated sediment in the Northern Channel, Marriage Road Ditch and North Patrol Road Ditch, and the contaminated soil in the berm above the Remedial Action Objectives (RAOs). As part of this action, the debris pile would also be removed. Contaminated sediment, soil and debris are to be disposed off site in Class I and Class II landfills. This Remedial Design Report provides the remediation and remedial design approach and includes the design drawings and specifications necessary to implement the selected remedial action for Site 27.

1.1 OBJECTIVE AND SCOPE OF WORK

The objective of this Remedial Design Report is to provide the design drawings, specifications and associated plans necessary to implement the selected remedial action for Site 27.

The scope of work includes 1) providing the results of the pre-design field sampling activities at Site 27; 2) describing the remediation and remedial design approach for the selected remedial alternative; 3) providing calculations to substantiate the design; 4) providing the design drawings and specifications, supplemental plans (Sampling and Analysis Plan [SAP], Data Management Plan, Stormwater Management Plan [SWMP], and Transportation and Disposal Plan [TDP]).

1.2 PROJECT ORGANIZATION AND POINTS OF CONTACT

The Navy Remedial Project Manager (RPM) for this project is Mr. Scott Gromko. Mr. Gromko, under the supervision of Rick Weissenborn, is responsible for project management, budget control, schedule maintenance, and contacting regulatory agencies. Mr. Gromko is also responsible for community relations and ensuring that the remedial design is in compliance with the applicable rules and regulations. Mr. Gary Munekawa is the Resident Officer in Charge of Construction (ROICC), responsible for the field technical oversight and quality assurance (QA) of the pre-design field activities.

The TN&A/TtEC team's Deputy Program Manager, Mr. Tim Garvey, Professional Engineer (PE), is responsible for general project administration and ensures the quality of all project activities and deliverables. Mr. Tim Garvey and TtEC's Project Manager (PjM), Mr. Abid Loan, are responsible for general project administration including overseeing budget, schedule, document preparation, and ensure the quality of all project activities and deliverables.

The technical lead, Mr. Abram Eloskof, was responsible for coordination and interfacing between the engineers, subcontractors and the Navy. Mr. Vince Richards, the Field Lead/Geologist, was responsible for managing the pre-design field activities, providing oversight to the subcontractors, and coordinating with the ROICC and the PjM. In addition, Mr. Vince Richards acted as the Project Quality Control Manager (PQCM). As the PQCM, Mr. Richards coordinated with the TN&A Quality Control (QC) Program Manager (Mr. John Fleissner) to ensure that all field activities were in compliance with the project specifications. The Site Health and Safety Specialist (SHSS) on site, Mr. Bill Ogle, was responsible for ensuring that field activities were conducted in compliance with the Site-Specific Health and Safety Plan (SHSP) (TN&A, 2005a). As the SHSS, he coordinated with the Project Environmental and Safety Manager (PESM), Mr. W. Fink, Certified Industrial Hygienist. Additional support was provided by other engineering and technical resources.

A project organization chart showing the relationship among select team members is provided as [Figure 1-3](#).

The following is a list of the key project, Navy, and regulatory contacts:

Agency	Contact	Title
BRAC Project Management Office West 1455 Frazee Road, Suite 900 San Diego, CA 92108	Mr. Scott Gromko (619) 532-0933	Remedial Project Manager
Integrated Product Team West (IPT West) ROICC P. O. Box 68, Building 107 Moffett Field, CA 94035	Mr. Gary Munekawa, P.E. (650) 603-9834	Project Engineer and Navy Technical Representative/ ROICC
EFA West ROICC P. O. Box 68, Building 107 Moffett Field, CA 94035	Mr. David R. Smith (650) 603-9836	Construction Manager Technician and Navy Technical Representative/ ROICC
EPA 75 Hawthorne Street, SDF-73 San Francisco, CA 94105	Ms. Alana Lee (415) 972-3141	EPA-RPM
WB, San Francisco Bay Region 1515 Clay Street, Suite 1400 Oakland, CA 94612	Ms. Adriana Constantinescu, P.G. (415) 972-3141	WB-RPM
NAVFAC SW 1220 Pacific Highway San Diego, CA 92132-5190	Mr. Narciso Ancog (619) 532-3046	Navy QA Officer
TN&A 317 East Main Street Ventura, CA 93001	Mr. Tim Garvey (805) 585-6386	Deputy Program Manager
TN&A 317 East Main Street Ventura, CA 93001	Mr. John Fleissner (414) 607-6734	QA Program Manager
TN&A 317 East Main Street Ventura, CA 93001	Ms. Ewelina Mutkowska (805) 585-6391	Project Chemist
TN&A 317 East Main Street Ventura, CA 93001	Mr. W. Fink (805) 585-2110	Program Health and Safety Manager
TtEC 1940 E. Deere Avenue, Suite 200 Santa Ana, CA 92705	Mr. Abid Loan (949) 756-7514	PjM
TtEC 1940 E. Deere Avenue, Suite 200 Santa Ana, CA 92705	Mr. Abram Eloskof (949) 756-7521	Technical Lead
TtEC 1940 E. Deere Avenue, Suite 200 Santa Ana, CA 92705	Ms. Mary Schneider (949) 756-7586	QC Program Manager

Agency	Contact	Title
TtEC 1940 East Deere Avenue, Suite 200 Santa Ana, CA 92705	Ms. Lisa Bienkowski (949) 756-7592	Program Chemist
TtEC 1940 E, Deere Ave, Suite 200 Santa Ana, CA 92705	Vincent Richards (949) 756-7568 (949) 283-0589	Field Lead/Geologist/PQCM
Former Naval Air Station Moffett Field TtEC North of Building 45 Cummins Avenue Moffett Field, CA 94035	Bill Ogle (650) 654-9868	SHSS
TtEC 1230 Columbia Street, Suite 500 San Diego, CA 92101	Roger Margotto, C.I.H. (619) 471-3503 (619) 981-4148 cell (714) 810-3742 pager	PESM

1.3 PROJECT SCHEDULE

The proposed schedule for the Site 27 remedial design is included as [Figure 1-4](#). The schedule is presented in a critical path method format. The schedule has been prepared using a PC-based cost, scheduling, and control system called PRIMAVERA[®]. PRIMAVERA[®] has many features, including the identification of critical paths and the ability to compare initial base plan to current project schedule.

Four main activities will be followed during the course of this project:

- **Stage 1 - Pre-design preparatory activities.** This stage includes preparation of the SHSP and SAP for pre-design field activities, notifications and procurement.
- **Stage 2 - Pre-design field activities.** This stage includes mobilization, geophysical survey, surveying, and collection of soil and sediment samples.
- **Stage 3 - Sediment bench-scale testing.** This stage includes a bench-scale test to evaluate 10 sediment samples. Each sample will be mixed with different types and/or amounts of solidifying reagents to determine what combination is best suited for solidification of the sediment.
- **Stage 4 - Remedial Design Report.** This stage includes the preparation and review of the Pre-Draft, Draft, Draft Final, and Final Remedial Design Report. Findings from the pre-design field activities and sediment bench-scale testing are presented in this report.

1.4 REPORT ORGANIZATION

The Remedial Design Report has been structured to provide details on the major aspects of the remedial design. The Remedial Design Report has been organized into nine sections, and 11 appendices (Appendices A through K and two attachments). [Section 1.0](#) provides an introduction and defines the scope of work. [Section 2.0](#) discusses the background and past operational history of the site. A summary of the site characteristics such as geology/hydrogeology, ecology and the nature and extent of contamination are presented in [Section 3.0](#). Project requirements including health and safety, environmental management, and transportation and disposal requirements are identified in [Section 4.0](#). [Section 5.0](#) provides a description of the site exploratory activities that were conducted in the pre-design phase. The remediation approach is described in [Section 6.0](#). The remedial design including the design approach, design criteria and engineering calculations are presented in [Section 7.0](#). Post-construction submittals that will be required are identified in [Section 8.0](#). References are included in [Section 9.0](#).

The following appendices are included to provide the data collected during the Site 27 pre-design site exploratory activities, as well as supplemental plans necessary to implement the remedial alternative:

- [Appendix A](#), Transportation and Disposal Plan
- [Appendix B](#), Stormwater Management Plan
- [Appendix C](#), Sampling and Analysis Plan
- [Appendix D](#), Data Management Plan
- [Appendix E](#), Survey Data
- [Appendix F](#), Geotechnical Data
- [Appendix G](#), Sediment Bench-Scale Testing Report
- [Appendix H](#), Calculations
- [Appendix I](#), Design Drawings
- [Appendix J](#), Specifications
- [Appendix K](#), Site Photographs
- [Attachment 1](#) includes applicable or relevant and appropriate requirements for the Northern Channel
- [Attachment 2](#) includes response to comments

2.0 SITE HISTORY

Moffett is located near the southern end of San Francisco Bay, approximately 35 miles south of San Francisco and 10 miles north of San Jose, California. The facility encompasses about 2,200 acres in Santa Clara County, California. See [Figure 1-1](#) for Vicinity Map.

Moffett was originally commissioned as Naval Air Station (NAS) Sunnyvale in 1933 to support the west coast dirigibles of the lighter-than-air (LTA) program. The Navy operated the facility as NAS Sunnyvale from 1933 to 1935 and again from 1942 to 1994. In 1935, NAS Sunnyvale was transferred to the U.S. Army Air Corps, which used the base for training purposes. The U.S. Army Air Corps operated the facility from 1935 to 1942. In 1939, a permit was granted to Ames Aeronautical Laboratory to use a portion of the base. NAS Sunnyvale returned to Navy control in 1942 and was renamed NAS Moffett Field. Initially supporting the west coast dirigibles of the LTA program, the facility later was used in a variety of aviation-related capacities, which included transport, training, and anti-submarine patrol activities.

NAS Moffett Field was closed as an active military base and the majority of the property was transferred to the National Aeronautics and Space Administration (NASA) on July 1, 1994, under the Base Realignment and Closure (BRAC) program. The facility was renamed Moffett Federal Airfield. The military housing on the base was transferred to the U.S. Air Force and subsequently to the U.S. Army.

Site 27 is located in the northeastern part of Moffett and is part of Operable Unit 6. Site 27 includes the Northern Channel, drainage ditches, and associated features such as:

- Marriage Road Ditch
- Patrol Road Ditch
- North Patrol Road Ditch
- Berms along the Northern Channel
- A debris pile located near the Building 191 lift station

Refer to [Figure 1-2](#) for locations of the aforementioned features.

The selected alternative in the Record of Decision (ROD) (BRAC Program Management Office [PMO] West, 2005) provides for remedial action of the Northern Channel, the North Patrol Road Ditch, the majority of the Marriage Road Ditch, and the western portion (first 800 linear feet) of the north and south slopes of the Northern Channel, as well as the debris pile. Since there is no action required for the Patrol Road Ditch or the north and south slopes of the Northern Channel east of the first 800 linear feet, it will not be discussed further.

The channel, ditches, berms and debris pile are impacted with polychlorinated biphenyls (PCBs), pesticides and metals. The probable source of contamination for Site 27 is historical surface water runoff. PCB contamination may have originally been introduced into the environment by releases from transformers using oil that contains PCBs. Historically, the Northern Channel has received stormwater runoff from Moffett and NASA Ames Research Center. The portions of the Northern Channel owned by Lockheed Martin Space Systems Company (Lockheed) and Cargill Salt (Cargill) extend eastward approximately 5,500 feet beyond Moffett's boundary. The areas that make up Site 27 that are impacted by the remedial design are described below.

Northern Channel - Historical information regarding Site 27 is incomplete. In the southern portion of San Francisco Bay, several artificial channels were built for navigational purposes. It is uncertain whether the Northern Channel was built for this purpose or if it was constructed as part of the Cargill saltwater evaporation pond system.

Maps from 1932 indicate that the Northern Channel received direct inputs from the former Lindbergh Avenue Ditch, Moffett's original stormwater drainage system, and from a former Moffett septic tank system. Stormwater was diverted to the eastern side of the base when the Moffett runway was extended northward in 1953. The Building 191 lift station was installed to convey water collected in the storm drain system and surface water from the eastern portion of Moffett under the runways to the Northern Channel.

Approximately 10,000 feet long and typically 40 to 50 feet wide, the Northern Channel continuously contains surface water. The bottom of the unlined channel lies approximately 2.8 feet below mean sea level (msl). The channel receives runoff from many of the drainage ditches at Moffett, as well as freshwater input from Building 191 outflow and saltwater input from groundwater recharge and the Cargill ponds. Water in the channel flows east approximately 1 mile beyond the eastern Moffett boundary and gravity feeds through a pipe to the terminus of the Lockheed Channel, where it is pumped into Moffett Channel, flows to Guadalupe Slough, and eventually reaches San Francisco Bay.

Marriage Road Ditch - The Marriage Road Ditch was built in the 1940s as part of the eastern expansion at Moffett. Located east of the runways, the Marriage Road Ditch divides the Moffett golf course and is approximately 2,300 feet long. The ditch is 5 to 6 feet below msl and portions are lined with a concrete bottom. The Marriage Road Ditch previously received runoff year-round from the East-Side Aquifer Treatment System (approximately 30 gallons per minute), until July 1, 2003, when the treatment system was shut down. The ditch receives runoff from the golf course, the runways, the east apron area, and the storm drains in the vicinity of Hangars 2 and 3. The Marriage Road Ditch drains into the North Patrol Road Ditch. The ditch provides habitat for insects, worms, snails, and the western pond turtle. Several species of plants grow in and along the sides of the ditch.

North Patrol Road Ditch - Constructed in 1933, this ditch runs 4,300 feet along the North Patrol Road, parallel and south of the Northern Channel. The ditch lies 5.5 feet below msl and the western portion is lined with concrete and generally contains water year-round. It carries surface water runoff from the Marriage Road Ditch, Patrol Road Ditch, and the golf course west to the Building 191 lift station, where it is pumped into the Northern Channel.

Debris Pile - The debris pile is located north of the Building 191 lift station at the west end of the Northern Channel, between the north bank of the channel and south bank of the United States Fish and Wildlife Service (USFWS) ponds, formerly Cargill evaporation ponds. The pile consists of possibly excavated sediments from the Northern Channel, construction debris, and riprap such as broken concrete, asphalt, and other debris left from the 1950s that may have been used to stabilize and prevent erosion of the berm on the west end of the Northern Channel.

Additional interested parties, based on their proximity and/or use of the Northern Channel and the associated berms, include the USFWS Lockheed Martin, Cargill Salt Company, NASA, and the City of Sunnyvale. In 2003, USFWS purchased the saltwater evaporation ponds adjacent to Site 27 from Cargill. The City of Sunnyvale owns ponds and a publicly owned treatment works facility located near the eastern end of the Northern Channel and also leases a portion of the berms for hiking and biking trails.

3.0 SUMMARY OF SITE CHARACTERISTICS

This section discusses site characteristics including geology, hydrogeology, ecology, climate and the nature and extent of contamination.

3.1 GEOLOGY/HYDROGEOLOGY

The following sections briefly describe the geologic and hydrogeologic characteristics at Moffett and the surrounding region.

3.1.1 Regional Setting

Moffett is located at the northern end of the Santa Clara Valley Basin, approximately 1 mile south of San Francisco Bay. Regionally, the Santa Clara Valley contains as much as 1,500 feet of interbedded alluvial, fluvial, and estuarine deposits (Iwamura, 1980). Locally, these sediments consist of varying combinations of clay, silt, sand, and gravel that represent the interfingering of estuarine and alluvial depositional environments during the late Pleistocene and Holocene epochs. The interfingering of fluvial and estuarine sediments in southern San Francisco Bay is related to worldwide fluctuations in sea level during glacial and interglacial episodes of the late Quaternary period (PRC Environmental Management, Inc. [PRC] and James M. Montgomery, Consulting Engineers, Inc. [JMM], 1992). The fluvial sediments were derived from the Santa Cruz highlands west of the basin and deposited on an alluvial plain bounded by alluvial fan deposits to the west and baylands to the northeast (Iwamura, 1980). These sediments were likely deposited during the Holocene period when the worldwide sea level was rising toward its present elevation.

3.1.2 Local Setting

The land at Moffett is relatively flat, ranging from 2 feet below to 36 above mean sea level (msl). A considerable portion of the site is situated on previously submerged land or marshlands that have been filled to their existing elevations with backfill material (Foster Wheeler Environmental Corporation [FWENC], 2002).

Surface geologic maps indicate that alluvial fan deposits extend toward the Santa Clara Valley Basin approximately to U.S. Highway 101, which is the southern boundary of Moffett (Tetra Tech EM, Inc. [TtEMI], 2003). Branching river and flood plain deposits are found in the shallow subsurface at Moffett. Estuarine deposits are found at the northernmost end of Moffett.

3.1.3 Surface Water and Groundwater

The only natural surface waters at Moffett are the wetlands located in the northern portion of the site. Nearby surface drainage includes Stevens Creek to the west and Coyote Creek and Guadalupe Slough to the east of Moffett (FWENC, 2002). A general discussion of the surface water features at Site 27, including the Northern Channel and associated ditches, is provided in [Section 2.0](#).

The shallow aquifer system at Moffett consists of the A aquifer zone, B aquifer and A/B aquitard, and C aquifer and B/C aquitard. Deep aquifers underlie the C aquifer. The A aquifer consists of sands and gravels and is located between the depths of approximately 5 and 65 feet below ground surface (bgs). The A aquifer zone is further divided into the upper A aquifer and (lower A aquifer by a discontinuous, low-permeability horizontal layer (upper A/lower A aquitard)), which is found between 25 and 30 feet bgs. Groundwater flow in the A aquifer is toward the north with a horizontal gradient of 0.004 to 0.005.

The B aquifer extends from approximately 60 to 120 feet bgs. Interbedded fine- to medium-grained sands and clayey sands characterize permeable deposits in the B aquifer along with silts and clays. Groundwater flow in the B aquifer zone is generally to the north with a horizontal gradient of 0.004 to 0.005.

The A/B aquitard, a continuous clay layer of late Pleistocene age between 45 and 65 feet below msl, has been observed in borings across Moffett. An even deeper (100 to 160 feet below msl) clay layer (B/C aquitard) corresponds to Sangamon-age interglacial deposits (PRC and JMM, 1992). Beneath this aquitard are undifferentiated alluvial gravels, sands, silts, and clays that make up the mid- to early- Pleistocene-age deposits and the Pliocene/Pleistocene-age Santa Clara Formation.

The C aquifer is confined and extends from 155 to greater than 500 feet bgs. This depth correlates with the upper Illonoian alluvium in the vicinity of Moffett (PRC Environmental Management, Inc. [PRC] and James M. Montgomery, Consulting Engineers, Inc. [JMM], 1992). The Illonoian alluvium was deposited during lower sea levels associated with glacial periods. Silt and clay predominate in the aquifer; however, 3 to 13 feet of discontinuous sand and gravel intervals are present (International Technology Corporation, 1993). The groundwater flow direction for the C aquifer zone is northeast with a horizontal hydraulic gradient of approximately 0.0005 (PRC and JMM, 1992).

Deep aquifers underlie the C aquifer at a depth greater than 240 feet bgs. These aquifers are composed of sand and gravel interbedded with silt and clay layers.

3.2 ECOLOGY

A summary of the ecological characteristics of the Northern Channel, Marriage Road Ditch and the North Patrol Road Ditch are provided herein.

Northern Channel

The bank slopes along the Northern Channel are partially eroded and support a moderate amount of shrubs. The vegetative community along the slopes primarily consist of mustard (*Brassica nigra*), salt brush (*Atriplex patula*), rip-gut brome (*Bromus diandrus*), rabbit's foot grass (*Polypogon monspeliensis*), coyote brush (*Baccharis douglasii*), and alkali heath (*Frankenia salina*). Vegetation along the banks are occasionally mowed. Along the lower edges of the Northern Channel, emergent hydrophytic vegetation such as alkali bulrush, pickleweed (*Salicornia virginica*), rabbit's foot grass, salt brush, and salt grass are found ranging from 2 inches to 2 feet in height.

The Northern Channel provides a brackish surface water habitat of moderate value to wildlife. It supports several fish and epibenthic invertebrate species such as mosquitofish (*Gambusia affinis*), longjaw mudsuckers (*Gillichthys mirabilis*), bay shrimp, crabs, and snails (PRC and Montgomery Watson [MW], 1995). During the habitat and receptor survey (Western Ecological Services Company, 1993), the most prevalent aquatic invertebrate observed was the water boatman (*Trichocorixa* spp.). These insects have a high tolerance of salinity and extremes in dissolved oxygen. A large number of freshwater gastropod shells, suggesting large populations of snails during the winter when salinity is reduced by surface water runoff were observed during benthic sampling of the Northern Channel in 1993 (Western Ecological Services Company, 1993). Several genera of empty snail shells (*Physa* spp., *Fossaria* spp., *Lymnaea paustris* group) were abundant in the benthic samples. It is believed that the channel undergoes seasonal shifts in its level of salinity. This may have impacted the ability of the freshwater snails to survive if there was a considerable change in salinity. In the top 6 inches of the channel bottom, numerous small conical snail shells (identified as *Assiminea californica*) were retrieved, some were found to contain live snails. These types of snails are known to survive in fluctuating levels of salinity.

During the Phase I Site-wide Ecological Assessment (SWEA) (PRC and MW, 1995), water birds including the pied-billed grebe (*Podilymbus podiceps*), common moorhen (*Gallinula chloropus*), mallard duck (*Anas platyrhynchos*), ruddy duck (*Oxyura jamaicensis*), black-necked stilt (*Himantopus mexicanus*), and Forster's tern (*Sterna forsteri*) were identified (PRC and MW, 1995). The great blue heron (*Ardea herodias*), the western pond turtle (*Clemmys marmorata*), a California species of concern (CSC), and the western burrowing owl (*Speotyto cunicularia*), also a CSC, have been observed at the Northern Channel (MW, 2000; National Aeronautics and Space Administration [NASA], 2002). In addition, the salt marsh yellowthroat (*Geothlypis trichas sinuosa*) may occur in this area.

Marriage Road Ditch

The habitat provided by Marriage Road Ditch is considered poor to moderate due to its limited size and frequent human disturbance. Marriage Road Ditch supports hydrophytic vegetation that grows in and along its sides such as narrow-leaved cattail (*Typha latifolia*), alkali bulrush, rabbit's foot grass, and curly dock (*Rumex crispus*). Invertebrates such as water boatmen, chironomids, and oligochaetes have been identified in the ditch. In addition, empty gastropod shells were found in the ditch. The western pond turtle, a CSC, has also been observed in the Marriage Road Ditch (NASA, 2002).

North Patrol Road Ditch

The North Patrol Road Ditch is considered to have a poor-quality habitat. The banks along the ditch consist of emergent hydrophytic vegetation including mustard, salt bush, rip-gut brome, rabbit's foot grass, pickleweed, and alkali heath. Species observed at North Patrol Road Ditch include the mallard duck, common moorhen, killdeer (*Charadrius vociferous*), mourning dove (*Zenaida Macroura*), and California ground squirrel. During the Phase I SWEA (PRC and MW, 1995), numerous gastropod shells were observed in benthic samples. In addition, two CSCs, the western pond turtle and the western burrowing owl, have been identified in the North Patrol Road Ditch (NASA, 2002) and use the habitat provided by the berm that separates the ditch from the Northern Channel.

3.3 CLIMATE

The climate at Moffett typically consists of dry summers and cool winters. High fog is consistent in the area during the summer, night, and morning. The average temperature is 58 degrees Fahrenheit (° F), with an average high of 65° F in September and a mean low of 45° F in January. In June and September, a maximum temperature of 100° F and in December and January, a minimum temperature of 22° F have been observed.

The average annual rainfall is 14.1 inches with a maximum monthly average in January of 2.8 inches. The driest months, May through September, have less than 0.5 inch per month (National Ocean and Atmospheric Administration, 2005). The average annual wind velocity is 7 miles per hour with moderate winds during the day from the north and southwest and from the west during the evening.

3.4 NATURE AND EXTENT OF CONTAMINATION

From 1995 to 2002, the Navy conducted a series of environmental studies, including an ecological risk assessment, in conjunction with NASA, U.S. Environmental Protection Agency (EPA), and California Water Board (WB). A summary of these environmental studies is provided herein; however, details are provided in the following documents:

- *Final Phase I Site-Wide Ecological Assessment* (PRC and MW, 1995)
- *Final Station-Wide Remedial Investigation Report* (PRC, 1996)
- *Final Phase II Site-wide Ecological Assessment* (PRC and MW, 1997)
- *Draft Northern Channel Characterization Report* (MW, 2000)
- *Northern Channel Feasibility Study (Site 27), Former Naval Air Station Moffett Field, Santa Clara County, California* (TtEM, 2003)

During these investigations, the ecology and the nature and extent of contamination at Site 27 were evaluated. Preliminary ecological investigations showed that various types of plants and animals common to wetland habitats populate the Northern Channel, associated drainage ditches, and the debris pile. These include salt-tolerant plants, waterfowl, shorebirds, the western pond turtle, western burrowing owl, rodents, and various types of invertebrates (insects, worms, and so forth).

To investigate the nature and extent of contamination, sediment and soil samples were taken. Surface water samples were also collected at different times at many of the sediment sampling locations. Samples were analyzed for a variety of chemicals of potential concern, including polychlorinated biphenyls (PCBs), organochlorine pesticides, metals, volatile organic compounds, semivolatile organic compounds, and total petroleum hydrocarbons. The investigations found chemicals, including PCBs, pesticides, and metals in sediment samples from the Northern Channel at levels that require cleanup. The highest concentrations of chemicals were generally beneath the top 3 inches of sediment. In the deeper clay layer, the levels of chemicals were much lower and did not exceed cleanup levels.

Chemical levels found in surface water samples for the site were generally acceptable. Additional studies were conducted that involved collecting fish and plants, as well as organisms from within the Northern Channel sediments. PCBs were detected in the organisms collected from within the sediments. PCBs, pesticides, and metals were detected at low levels in most fish and in some plant tissue samples collected throughout the Northern Channel.

The Marriage Road Ditch, East Patrol Road Ditch, and North Patrol Road Ditch areas of Site 27 were systematically sampled in May 2002 to characterize the concentrations of chemicals in sediments and soil. Samples were analyzed for PCBs, pesticides, metals, and total organic carbon. Surface water samples were also collected and analyzed for PCBs, pesticides, total and dissolved metals, particulate organic carbon, and dissolved organic carbon.

PCBs were detected above cleanup levels in the upper sediment layers and soil of the Marriage Road Ditch and in the North Patrol Road Ditch. Concentrations of PCBs in the deeper clay layer samples from these areas were below the cleanup levels for total PCBs. Pesticides and metals were detected above the cleanup levels in the Marriage Road Ditch, but generally below cleanup levels in the other two ditches.

PCBs and pesticides were not detected in any surface water samples from the Marriage Road Ditch, East Patrol Road Ditch, or the North Patrol Road Ditch. A few metals were detected in surface water samples from the three ditches at levels slightly above EPA ambient water quality criteria values for freshwater.

Soil samples were collected along the entire length of the berm on the northern side of the Northern Channel and from the Building 191 lift station to the Fuel Pier Bridge along the berm on the south side. The remainder of the southern berm running to the east (Lockheed berm) was not sampled at this time. All samples were analyzed for PCBs, pesticides, and metals. PCBs, pesticides, and metals were detected at concentrations above cleanup levels at the western end of the Northern Channel and from the debris pile.

3.4.1 Risk Summary

Several risk assessments have been conducted of the Northern Channel to assess potential risks to both humans and ecological receptors. Ecological risks associated with the contaminated sediment in the Northern Channel were evaluated as part of the Phase II SWEA (PRC and MW, 1997). This assessment concluded that there is little to no likelihood of adverse effects on ecological receptors from surface water exposure. However, it was determined that a moderate to high likelihood of potential adverse effects on infaunal populations for benthic sediment receptors and avian receptors exists. The Phase II SWEA identified the great blue heron, mallard duck and the black-necked stilt as representative receptors, as well as assessment and measurement endpoints. Based on evaluating risk to both benthic and avian receptors, the following chemicals of potential ecological concern (COPECs) were identified: total Aroclors or total PCBs, total dichlorodiphenyltrichloroethane (DDT), total chlordane, cadmium, lead, mercury, selenium, silver and zinc.

A human health risk assessment was conducted as part of the Station-Wide Remedial Investigation (RI) (PRC, 1996). The results identified potential risk for occupational exposure posed by Aroclor 1254 and Aroclor 1260.

The ecological risk evaluation (PRC and MW, 1997) identified that PCBs, pesticides and metal contaminants in the sediment present risks to benthic and avian receptors. Although potential human risks were identified in the RI (PRC, 1996), the primary risk concern for the Northern Channel is considered the risk to ecological receptors.

Additional data were collected as part of a data gaps field investigation in May 2002 and were used to prepare a comprehensive ecological risk assessment for the Northern Channel that was presented in the Feasibility Study (FS) (TtEMI, 2003). The site-specific assessment endpoints that were used for the evaluation were the great blue heron, mallard duck, black-necked stilt and the western pond turtle. The results of the risk assessment indicated that the highest risks are associated with the black-necked stilt, and to a lesser extent, the great blue heron. The results of

the comprehensive ecological risk assessment were used to develop the Remedial Action Objectives (RAOs) for the site.

3.4.2 Remedial Action Objectives (Cleanup Goals)

The primary RAOs for this remedial action, as identified in the Record of Decision (ROD) (Base Realignment and Closure Program Management Office West, 2005), is to reduce direct exposure of ecological receptors to the Site 27 COPECs in sediments and soil to levels that are protective of birds in the Northern Channel and related areas. The specific COPECs and their respective cleanup goals are as follows:

- Total PCBs: 0.35 milligrams per kilogram (mg/kg)
- Total DDT: 0.0648 mg/kg
- Total chlordane: 0.931 mg/kg
- Cadmium: 184 mg/kg
- Lead: 173 mg/kg
- Mercury: 1.52 mg/kg
- Selenium: 0.926 mg/kg
- Silver: 13.7 mg/kg
- Zinc: 720 mg/kg

The Preliminary Remediation Goals (PRGs) for residential use were used as cleanup goals for PCBs and other COPECs in soil in the berms along the Northern Channel. Therefore, the cleanup goals for the berms are:

- Total PCBs: 0.22 mg/kg
- Dichlorodiphenyldichloroethane: 2.4 mg/kg
- Dichlorodiphenyldichloroethene: 1.7 mg/kg
- DDT: 1.7 mg/kg
- Total chlordane: 1.6 mg/kg
- Cadmium: 37 mg/kg
- Lead: 150 mg/kg
- Mercury: 23 mg/kg

4.0 PROJECT REQUIREMENTS

Requirements for the implementation of the remedial design such as health and safety, environmental management, transportation and disposal, stormwater management, sampling and analysis, community relations, contractor quality control (QC), document control, and meetings and reports are discussed in this section

4.1 HEALTH AND SAFETY REQUIREMENTS

Personnel who work at hazardous waste project sites are required to meet the Occupational Safety and Health Administration training requirements defined in Title 29 Code of Federal Regulations (CFR) [29 CFR, Part 1910.120(e)]. These requirements are: (1) 40 hours of formal off-site instruction; (2) a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor; and (3) 8 hours of annual refresher training.

Field personnel who directly supervise employees engaged in hazardous waste operations also receive at least 8 additional hours of specialized supervisor training. The supervisor training covers health and safety program requirements, training requirements, personal protective equipment (PPE) requirements, spill containment program, and health-hazard monitoring procedures and techniques. At least one member of every sampling team will maintain current certification in the American Red Cross "Multimedia First Aid" and "Cardiopulmonary Resuscitation (CPR) Modular," or equivalent.

Copies of health and safety training records, including course completion certifications for the initial and refresher health and safety training, specialized supervisor training, and first aid and CPR training, are to be maintained in the contractor's project files. A Site-Specific Health and Safety Plan (SHSP) will be developed by the contractor for this project and a copy will be on site at all times while work is being done.

Before work begins at a specific hazardous waste project site, the contractor's personnel are required to undergo site-specific training that thoroughly covers the following areas:

- Names of personnel and alternates responsible for health and safety at the project site
- Health and safety hazards present on site
- Selection of the appropriate personal protection levels
- Correct use of PPE
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment on site

- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazardous substances

The selected contractor will be responsible for preparing a SHSP for the work associated with the remedial design implementation at Site 27. The SHSP should be comprised, at a minimum, of the following elements:

- Introduction
 - Purpose and Scope
 - Application
 - Summary of Major Risks
- Key Personnel and Organization
- Site History and Project Description
 - Project Description
 - Project Duration
- Potential Hazards
 - Chemical Hazards
 - Environmental Hazards
 - Physical Hazards
- Activity Hazard Analysis
- Training
- PPE
- Medical Surveillance
- Air Monitoring and Other Monitoring Activities
 - Direct Reading Instruments
 - Monitoring Strategy
 - Quality Assurance (QA)/QC
- Site Control
 - Exclusion Control
 - Contamination Reduction Zone
 - Support Zone
- Medical Surveillance Procedures
- Safety Considerations
- Disposal Procedures

- Accident Prevention Plan
- Emergency Response Plan
- Logs, Reports, and Recordkeeping

4.2 ENVIRONMENTAL MANAGEMENT REQUIREMENTS

This section has been prepared to provide environmental compliance procedures, as well as regulatory, procedural, and training requirements associated with implementing this remedial design plan at Site 27.

This project is part of the Navy's responsibility under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and under the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), better known as the "Superfund" program, to remediate contaminated sites at Moffett. The EPA proposed Moffett as a Superfund Site on the National Priorities List (NPL) in June 1986 and placed it on the NPL in 1987. The necessary permits or authorizations for conducting work described in this remedial design plan will need to be obtained. However, since this project is part of the Navy's responsibility under the Installation Restoration Program (IRP) and CERCLA, the activities for this project may be completed pursuant to the permit exemption in Section 121(e) of CERCLA. The permit exemption in Section 121(e) of CERCLA applies to agency-directed actions.

The work will be performed in accordance with Site 27 Record of Decision (ROD) (Base Realignment and Closure [BRAC] Program Management Office [PMO] West, 2005). A summary table of these applicable or relevant and appropriate (ARARs) is included in [Attachment 1](#). The Navy's responses on the regulatory comments on the Draft Remedial Design are included as [Attachment 2](#).

The following permit and agency review requirements will need to be implemented prior to commencing project activities associated with the remedial design because several regulatory agencies have jurisdiction and authority that may affect the proposed project.

Joint Aquatic Resource Permit Application

The remedial design includes activities that fall under the provisions of the Joint Aquatic Resource Permit Application (JARPA) process. JARPA authority for the San Francisco Bay Area allows a single application to be submitted for review by multiple agencies that have jurisdiction and permit authority for projects conducted along the San Francisco Bay and projects conducted near or within wetlands or creeks that flow to the bay. However, since this project is part of the Navy's responsibility under the IRP and CERCLA, the JARPA jurisdictional activities for this project will be completed pursuant to the permit exemption in Section 121(e) of CERCLA. Specifically, the substantive JARPA requirements will be met, but no formal JARPA permit application will be requisite.

California Department of Fish and Game Code and California Endangered Species Act

Only the California Endangered Species Act (ESA) was identified as a state ARAR. California Fish and Game Code, Section 2080, prohibits importing, exporting, taking, possessing, or selling of any state candidate, threatened, or endangered species. The substantive provisions of Section 2080 are also relevant and appropriate, and the Navy has selected it as an ARAR.

United States Army Corps of Engineers

The project involves several factors that serve to alleviate the applicability of Section 404 (b) (1) of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act (RHA) requirements as overseen by the United States Army Corps of Engineers (USACE). Agency-directed CERCLA-related activities do not require a project proponent to obtain permits under Section 404 of the CWA or Section 10 of RHA. As a courtesy, at the Navy's request, the USACE local District Ecologist will need to be informally consulted on the status of this project.

Work conducted pursuant to the remedial design will be completed in accordance with the substantive aspects of Nationwide Permit 38 (NWP 38), which pertains to activities required to affect containment, stabilization, or removal of hazardous and toxic wastes. However, the general conditions of NWP 38, which include provisions for delineating sensitive areas of vegetation and aquatic sites, minimizing impacts from heavy equipment usage, controlling soil erosion and sediment, preventing harm to aquatic life movements, and protecting endangered species will be requisite. As a courtesy, for work activities conducted in the San Francisco Bay area, a copy of the NWP 38 conditions will be kept within the project trailer during site activities. Furthermore, project staff will be required to receive training to become familiar with the requirements of the permit and will be educated about how each of the NWP requirements are being met.

San Francisco Bay Conservation and Development Commission

The Bay Conservation and Development Commission (BCDC) is authorized under state law and under the federal Coastal Zone Management Act to review federal projects to determine "federal consistency." Typically, the BCDC requires a permit for development within a shoreland area or within the shoreline band, as defined by the BCDC as those lands extending landward for 200 feet in all directions from the ordinary high-water mark; floodways and contiguous floodplain areas landward 200 feet from such floodways; and all wetlands and river deltas associated with the streams, lakes, and tidal waters, and as a band that extends 100 feet inland from areas subject to tidal action. The permits are required for any person proposing to fill, extract materials, or change the use of water, land, or structures in or around San Francisco Bay, which includes salt ponds and managed wetlands.

During implementation of the remedial design, the substantive BCDC requirements will be met without a formal BCDC permit application and review pursuant to the permit exemption in

Section 121(e) of CERCLA. The BCDC's own published permit application requirements and conditions of project certification do not apply to federal projects, projects that require federal approval, or project activities that are supported by federal funds. Therefore, the Navy is not required to submit an application or obtain a permit from the BCDC to implement the remedial design. As a courtesy, project information will need to be submitted at the Navy's request to support the BCDC in an informal federal consistency determination.

Endangered Species Act

Under Section 7 of the ESA, federal agencies must consult with the National Marine Fisheries Service at the National Oceanic and Atmospheric Administration for marine and anadromous species, and/or the United States Fish and Wildlife Service (USFWS) for most freshwater and terrestrial wildlife and plant species if they are proposing an action that may affect protected species or their habitats. It has been determined that federally listed species may be present within the project area, and a biological assessment and informal consultation will be required to analyze the potential effects of this project on federally listed species and their designated habitat.

Several federally listed species have been historically observed at Moffett. However, no federally listed species are known to permanently reside or breed within the Site 27 remedial design direct or indirect impact area at this time. The San Francisco Bay is a seasonal home for birds migrating along the Pacific Flyway, and numerous species of migratory and resident wildlife have been observed at Moffett. Several environmental resource surveys have been previously performed at Moffett. The project impacts will ultimately need to be discountable, short-term and fully mitigated. ESA protected species with potential to be encountered in the project area have been identified in [Table 4-1](#).

Executive Orders

Two Executive Orders (EOs) in 1977 established policies for all federal agencies associated with wetland and floodplain impacts. EO 11990, Protection of Wetlands, required all federal agencies to "take action to minimize the destruction, loss or degradation of wetlands and enhance the natural and beneficial values of wetlands" while carrying out their responsibilities. EO 11998, Floodplain Management, required similar protection for floodplains, including avoiding activity in the floodplain when possible.

In order to meet the substantive aspects of these EOs, project implementation will need to include any practical and avoidable wetland or floodplain impacts. Site-specific measures will need to be implemented to fully mitigate project activities (limit construction schedule to avoid adverse impacts to special-status species, provide biological monitoring during excavation and mobilization/demobilization activities, limit hours of operation during sensitive times of the year, delineate sensitive habitat areas [including but not limited to wetlands and floodplains] to limit

disturbance). The project will not be allowed to result in a permanent net loss of jurisdictional wetlands or sensitive floodplain habitat.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (Title 16 United States Code, Sections 703–712) prohibits at any time, using any means or manner, the pursuit, hunting, capturing, and killing or attempting to take, capture, or kill any migratory bird. This act also prohibits the possession, sale, export, and import of any migratory bird or any part of a migratory bird, as well as nests and eggs. A list of migratory birds for which this requirement applies is found at 50 CFR, Section 10.13. It is likely that species listed under Section 10 of the MBTA will occur within the project area. MBTA protected species will mandate special consideration as well, e.g., biological surveys, construction-timing restrictions, and monitoring. Effects on MBTA-protected species are generally avoided by not scheduling work, which could affect nesting habitat during the window when birds are/could be present (March 31 and September 15). If avoidance is not practical, on-site personnel can be trained and natural resource clearance surveys can be implemented prior and within 24 hours of field activities.

4.3 TRANSPORTATION AND DISPOSAL REQUIREMENTS

A Transportation and Disposal Plan (TDP) was developed for the remedial action at Site 27 and is provided in [Appendix A](#). The TPD identifies the types and amounts of waste expected to be generated during remedial activities, as well vehicular traffic control information related to the loading and off-site transportation and disposal of wastes and clean import materials. The plan presents environmental mitigation procedures for potentially hazardous soils and non-hazardous soils that will be transported from the site, emergency response procedures, transporter licensing and certification requirements, health and safety compliance, and base regulations. In addition, the locations of major points of ingress and egress at the site and major on-site and off-site roads that will be used by project personnel vehicles and for material transportation from the site are provided.

4.4 STORMWATER MANAGEMENT PLAN

A Stormwater Management Plan (SWMP) was prepared for implementation by the selected contractor during construction activities and is provided in [Appendix B](#). The SWMP provides the measures to be implemented during construction that minimize sediment and other pollutants in stormwater discharges. This plan identifies the sources of sediment and other pollutants that may affect the quality of stormwater discharges and describes the Best Management Practices necessary to reduce sediment and mitigate potential pollutant sources.

4.5 SAMPLING AND ANALYSIS REQUIREMENTS

A Sampling and Analysis Plan (SAP) containing the elements of a Field Sampling Plan and Quality Assurance Project Plan was developed and provided in [Appendix C](#). The selected contractor will be responsible for the implementation of this SAP during construction. The SAP provides field sampling procedures, QA/QC requirements, data gathering methods, data quality objectives, and data management procedures.

4.6 COMMUNITY RELATIONS ACTIVITIES

Several community relation activities will be conducted to inform the public about the Remedial Design Report and associated pre-design field activities. As the lead agency responsible for the remedial design of Site 27, the Navy is responsible for conducting community relation activities associated with this work.

4.6.1 Public Information

For a complete record of activities associated with this remedial design, documents will be contained in an information repository that is located at:

Mountain View Public Library
585 Franklin Street
Mountain View, California 94041
(650) 903-6337

The complete Administrative Record is located at 1220 Pacific Highway, San Diego, California, and is maintained by Ms. Diana Silva, Naval Facilities Engineering Command, Southwest (NAVFAC SW) Administration Record Manager, (619) 532-3676.

4.6.2 Public Participation

To encourage local participation in the hazardous waste cleanup program at Moffett, the Navy established a Restoration Advisory Board (RAB). This board is a citizen-based committee representing local community interests. RAB meeting agendas, minutes, and presentation materials are included in the Administrative Record for public review.

The work at Site 27 will be discussed at regularly scheduled community meetings and with the RAB. All meetings are advertised locally in an effort to encourage public attendance and participation.

4.7 CONTRACTOR QUALITY CONTROL REQUIREMENTS

A Contractor Quality Control (CQC) Plan will need to be developed for the implementation of this Remedial Design Report to provide an effective QC system that will ensure the quality of work performed by the selected contractor and its subcontractor personnel. The purpose of the

CQC Plan is to establish the specific procedures and methods for field inspections to be performed.

The CQC Plan should be comprised, at a minimum of the following elements:

- Introduction
 - Purpose/Site Background
 - Scope
- Organization and Responsibilities
- Submittals
 - Review of Submittals
 - Submittal Process
 - Approval Process
 - Revised Submittals
- Testing (other than chemical sampling and analysis)
- Field Inspection Plan
 - Coordination and Mutual Understanding Meeting
 - QC Meeting
 - Preparatory Phase Inspection
 - Initial Phase Inspection
 - Follow-up Phase Inspection
 - Completion Inspection
 - Inspection Documentation
- Documentation
 - CQC Reports
- Nonconformances
 - Identification of Nonconforming Items
 - Disposition
 - Corrective Actions
- Quality Management

Attachments to the CQC Plan shall include resumes of key personnel, a delegation of authority letter, QC forms and a submittal register (if applicable).

4.8 DOCUMENT CONTROL

TN&A's internal document control procedures will be followed for the duration of the pre-design and design activities. Additional guidance provided by the Navy will be used for document control, particularly for matters relating to regulatory compliance. Management of internal and external correspondence will be administered at the home office in Ventura, California. Document control will include assigning an alphanumeric code to each submittal.

Data to be collected during construction will be managed in accordance with the Data Management Plan ([Appendix D](#)). The Data Management Plan also addresses the retention of records following completion of the project.

4.9 MEETINGS AND REPORTS

Project status/CQC meetings will be held weekly (or at less frequent intervals if desired by the Resident Officer in Charge of Construction (ROICC) during pre-design field activities and construction. The meeting will be held at the project site. During pre-design field activities, the meeting will be attended by the Project Quality Control Manager (PQCM), ROICC, ROICC Construction Management Technician, Site Health and Safety Specialist (SHSS), and Field Lead (personnel identified in [Section 1.2](#)). During construction, the selected contractor will designate a PQCM, SHSS and Site Superintendent that will attend this meeting with the ROICC and ROICC Construction Management Technician. The PQCM will notify the ROICC at least 48 hours in advance of each meeting. The following shall be accomplished at each meeting:

- Review the minutes of the previous meeting.
- Review the schedule.
- Review the status of submittals.
- Review the work to be accomplished in the following 2 weeks and documentation required. Schedule QC inspections and testing.
- Resolve QC and production problems.
- Address items that may require revisions to the Project CQC Plan.

Minutes of the meetings were prepared by the T N & Associates, Inc. and Tetra Tech EC, Inc. team (during pre-design field activities) and will be prepared by the contractor during construction and submitted to the Navy. Daily reports were prepared by the Field Lead (during pre-design field activities) and will be prepared by the PQCM (during construction) and submitted to the ROICC. Monthly reports will be prepared by the PjM and submitted to the Remedial Project Manager. The monthly reports will include work completed by the end of each month and work that is planned for the following month.

5.0 SITE EXPLORATORY ACTIVITIES

This section provides a brief description of the pre-design field activities that were conducted between May 11 and June 8, 2005, to gather necessary data in order to develop the remedial design for Site 27. These activities included surveying, collecting soil samples for geotechnical testing, and collecting sediment samples for geotechnical and bench-scale testing.

5.1 TOPOGRAPHICAL SURVEY

Coast Surveying, Inc., a California-licensed surveyor performed land survey services from May 31 through June 8, 2005, of existing site conditions for the Northern Channel, including the channel invert, connecting drainage control features, North Patrol Road Ditch, Marriage Road Ditch, and the debris pile, which encompassed an area of approximately 55 acres. The survey area also included adjacent embankments, berms, and areas contributing surface water run-on into the Northern Channel.

Survey control point information for the Moffett topographic survey was provided by the T N & Associates, Inc. and Tetra Tech EC, Inc. (TN&A/TtEC) team prior to conducting the field survey activities.

The topographic survey was needed to document the bottom of the Northern Channel, which had approximately 3 to 4 feet of standing water. The channel width is approximately 30 feet wide and required four elevations shots, one on each bank and two shots on the channel's invert per 50 feet of channel length. The topographic survey also documented existing surface hardscape, roadway width, drown and ditch invert, utility boxes, drainage features, pipe size/type and inverts, fence lines and gates.

Coast Surveying, Inc. performed the survey using third-order, Class I accuracy. Horizontal control (northings and eastings) was tied to the California Coordinate System Zone III, North American Datum of 1983. The site elevations are based on the North American Vertical Datum of 1988. Horizontal and vertical control for this survey was based on National Aeronautics and Space Administration (NASA)-AMES Research Center monuments ARC 32 and ARC 33 as follows:

- ARC 32: Northing - 1,981,291.82, Easting - 6,111,764.27, elevation 1.85 feet
- ARC 33: Northing - 1,981,644.34, Easting - 6,114,233.04, elevation 5.49 feet

[Appendix E](#) of this report contains the survey coordinate information stamped by a California-licensed surveyor.

5.2 GEOTECHNICAL INVESTIGATION

In order to ensure that the slope of the bank will be stable after excavation of the sediment, a slope stability analysis was performed. The slope stability analysis ([Section 7.3.3](#)) requires the determination of physical parameters such as sieve analysis, moisture content, soil shear strength, soil density, and depth of water level.

The geotechnical investigation was performed at the site on May 13, 2005. The drilling consisted of five soil borings along the North Berm Haul Road as illustrated in [Figure 1-2](#). The spacing between the soil borings was approximately 2,000 feet. The objective was to sample the clay layer. A hand-auger was used for utility clearance from zero to 5 feet bgs at each of the five soil boring locations. Clay was logged at each boring location at the 5-foot interval. Subsequently, a split-spoon sampler was used in conjunction with a hollow-stem auger (HSA) drill rig to test the soil properties at the 5-foot interval. The HSA was then advanced to a depth between 7 and 10 feet below ground surface (bgs) and an undisturbed soil sample was collected using a Shelby tube. Soil samples were collected in accordance with the procedures described in Section 6.1 of the Final Sampling and Analysis Plan (SAP) for Pre-Design Geotechnical Investigation for Site 27 (TN&A, 2005b). The geotechnical data collected for this investigation is provided in [Appendix F](#).

5.3 SEDIMENT DRYING BENCH SCALE

Sediment samples were collected from five locations along the bottom of the Northern Channel at approximately every 2,000 feet, adjacent to the soil boring locations collected along the North Berm Haul Road on May 11, 2005, in accordance with the procedures described in Section 6.2 of the Final SAP for Pre-Design Geotechnical Investigation for Site 27 (TN&A, 2005b). The samples were collected from the bank of the channel by extending sampling equipment into the channel. The sediment layer is submerged in approximately zero to 4 feet of water and lies on a clay layer. Three adjacent samples (together totaling approximately 5 to 10 pounds) were collected at each of the five locations using a sludge sampler. These samples were placed in acetate sleeves, sealed, labeled and stored in an ice cooler for delivery by courier to Twining Laboratories of southern California located in Long Beach, California. The samples were ultimately homogenized together by the laboratory to create one sample. The consolidated sample was divided into 14 specimens (12 for bench-scale testing, 1 for sieve analysis, and 1 for air-drying). Each of the 12 specimens for bench-scale testing was mixed with different types and/or amounts of solidifying reagent (as shown below), and a moisture content analysis was obtained after mixing. A paint filter test was then performed on each specimen in accordance with EPA Method 9095 to determine if free liquids were present.

Sample	Type of Reagent	Amount of Reagent (Percent Dry Weight of Specimen Tested)
1	WLPM	0.5
2	WLPM	0.6
3	WLPM	0.8
4	WLPM	1.0
5	WLPM	1.5
6	WLPM	1.75
7	WLPM	2.0
8	LKD	25
9	LKD	30
10	LKD	35
11	LKD	37
12	LKD	40

The natural state of sediment is fully saturated with water. The excavated sediment will need to be solidified in order to satisfy the disposal facility requirement for water content. The bench-scale test was performed to determine the type and quantity of reagent necessary to meet the water content requirement of the disposal facility. The objective of the bench-scale testing was to determine which reagent is best suited for solidifying the sediment based on the results of the paint filter test performed in accordance with U.S. Environmental Protection Agency (EPA) Test Method 9095. Different reagents [waste lock polymer material (WLPM) or lime kiln dust (LKD)] at various percents per dry weight (see table above) were mixed in order to determine the most efficient combination to solidify the sediment. The reagent/mixing ratio of WLPM at 0.6 to 1.0 percent (assuming no visible water is observed) was selected for implementation during remedial activities based on the combination to pass the paint filter test and cost effectiveness. A summary of the bench-scale test results is provided in [Appendix G](#).

6.0 REMEDIATION APPROACH

The primary objective of the TN&A team's scope of work is to develop the remedial design documents for implementation of the proposed remedial action at Site 27. However, details of the proposed remedial activities and approach are presented in this section to establish a basis for the development of the remedial design documents. The Navy has selected excavation and off-site disposal as the preferred remedial response for the contaminated sediments from the Northern Channel, Marriage Road Ditch, and North Patrol Road Ditch and contaminated soil from the slopes of the Northern Channel (800-linear foot section) and the debris pile where chemical levels are higher than the Remedial Action Objectives (RAOs) (see [Section 3.4.2](#)). The total volume of sediments and soil to be excavated is approximately 65,000 cubic yards, which will be disposed off site at a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-approved landfill. The implementation of the selected remedial response will involve the following activities discussed in the subsections below.

6.1 MOBILIZATION

Mobilization for field activities for this project is anticipated to be in April 2006. Excavation activities are anticipated to begin in May 2006. Furthermore, the current remediation approach requires that sediment excavation activities must be completed during the dry season during May to September time frame. Mobilization activities includes installation of temporary facilities (office trailers, electrical service, telephone service, and so forth), conducting health and safety on-site training for the field crew, receiving health and safety certifications, delivery of heavy equipment and materials, construction of temporary site accesses, installation of temporary erosion and sediment controls, and installation of temporary perimeter fencing.

6.2 SITE PREPARATION ACTIVITIES

Access to the excavation areas at Site 27 will be limited to one entrance to be constructed west of Site 27, where the sediment and equipment staging area will be located. Emergency exits will be through the Fuel Pier Bridge and the Sunnyvale publicly owned treatment works (POTW).

Prior to beginning intrusive construction activities, a utility markout will be performed to locate overhead and underground utilities. Vegetation clearance will be conducted in areas where they will interfere with performing excavation activities and the fence line will be relocated using sections of temporary chain-link fence to control access across to the construction and staging areas.

6.3 UTILITY MARKOUT

Prior to any remedial construction activities, the selected contractor shall review existing utility maps and contact National Aeronautics and Space Administration (NASA) and Dig Alert to

schedule a utility markout to fulfill requirements of receiving a dig safe permit. Receiving a dig safe permit would allow site personnel to begin intrusive construction activities and make them aware of the potential for disturbing utilities in the vicinity of the excavation areas. Dig Alert permit(s) will need to be posted at both construction entrances to the site at all times during remedial construction activities. A geophysical utility survey and potholing, to confirm the depth of the utilities, shall also be performed prior to commencing any construction activities. All underground utilities identified within the excavation, berm boundaries and staging areas will be marked and protected for the duration of construction activities.

6.4 EROSION AND DRAINAGE CONTROL

Erosion and drainage control measures will be implemented in accordance with the Stormwater Management Plan (SWMP) developed as part of the remedial design. In preparation for construction, the field crew will be required to attend a SWMP training session. Damming systems will be installed in the Northern Channel. Aquatic and riparian protection will be implemented in accordance with the design package.

Prior to construction, vegetation clearance, including the removal of a number of existing trees within the work area, may be required. Trees located within the construction area will be cut and eventually used for firewood. Remaining tree stumps will be grounded in place using stump grinders. All existing vegetation (grass) will be cut to less than ½-inch in height. Grass clippings and miscellaneous tree limbs will be collected and disposed off site at the Zanker Road Class III Landfill located in San Jose, California.

6.5 SEDIMENTS CHARACTERIZATION

In situ sampling will be conducted to characterize the sediments in place prior to excavation. The details of the sampling activities are outlined in the Sampling and Analysis Plan (SAP). The results of the in situ sampling activities will be used to direct the temporarily on-site staging of the excavated sediments to either the non-hazardous or the non-Resource Conservation and Recovery Act (California hazardous) staging stockpiles, as well as for meeting the acceptance requirements of the disposal facilities.

6.6 FIELD SURVEYING

Following environmental control activities and prior to in situ sampling and excavation activities, a construction field survey will be performed. The Northern Channel, North Patrol Road Ditch and Marriage Road Ditch will be staked every 50 linear feet, and an in situ waste characterization sample will be collected per the SAP ([Appendix C](#)). To establish grade-staking cut and fill for excavation activities, the limits of work will be staked at 50-foot intervals. The subsequent clay barrier layer will be surveyed according to this grid system. After the channel and ditches are excavated, the confirmation sample locations will be surveyed, as described in the SAP ([Appendix C](#)). A final as-built survey of all surface features within the Northern

Channel, North Patrol Road Ditch and Marriage Ditch will be performed by a licensed California surveyor. The final survey will include all identifiable attributes of the drainage course, including drainage and pump features. The record drawings will be provided in the closeout report.

6.7 CHARACTERIZATION OF SEDIMENTS, SOIL AND DEBRIS

In situ sampling of the sediments within the Northern Channel, North Patrol Road Ditch, Marriage Road Ditch and the soil on the north and south slopes of the Northern Channel (western portion, first 800 feet) will be sampled for waste characterization purposes.

Debris from the debris pile location will be stockpiled on a lined portion of the equipment storage area. Samples will be collected from this stockpile for characterization purposes. As stated in [Section 6.5](#), the details of the sampling activities are outlined in the SAP.

Upon completion of the debris sample analysis, the debris will be loaded for removal from the site to an approved landfill. The soils below the debris area will be excavated and temporarily located to the side and tested to determine if it is clean or hazardous material. If the material is determined to be clean, it will be used as common fill material within the project location. If the underlying soil is determined to be hazardous waste, it will be used as protective cover over the liner in the sediment stockpile area and removed from the site at the end of the project.

Sediments from the Marriage Road Ditch will be removed first, followed by the North Patrol Road Ditch. The sediments in the Northern Channel will then be removed in a sequential approach. The Northern Channel construction area will be subdivided into 10 work areas designated construction zones 1 through 10. Starting at construction zone 1, field activities in each zone will involve dewatering, sediment excavation and construction restoration. Field activities will proceed in the same manner for all zones. Upon completion of the sediment excavation and successful completion of the confirmation sampling and analysis, final grading and aquatic and riparian restoration construction will be initiated for the specific construction zone.

Dewatering of the construction zones will require a temporary damming system such as Portadam[®] or equivalent. Safety issues related to the temporary damming system selected will be addressed in the Site-Specific Health and Safety Plan (SHSP), which will be prepared by the contractor selected to implement the remedial action. It should be noted that the backwater behind the Portadam will be limited to a height of not more than 4 feet during activities. Bypass and dewatering of the construction zones in the Northern Channel will require the use of a diesel- or electrical-powered pump capable of providing 1,500 gallons per minute (gpm) flow rate. A second backup pump system, capable of providing an additional 2,500 gpm, will be provided to convey the average September 24-hour storm.

In general, the sediments will be excavated down to the clay layer. The excavation depth will be completed to either the depth specified by the grade stakes based on the Feasibility Study (FS)

(Tetra Tech EM, Inc. [TtEMI], 2003) cross sections or 6 inches below the underlying clay layer, whichever depth will be reached first, in order to leave adequate channel bottom drainage grade flow lines. A competent person capable of identifying the target lithology should perform the field verification to confirm that the excavation has been completed to the clay layer. Excavated sediments will be loaded directly to off-road dump trucks equipped with watertight gates. The contractor shall make every attempt to drain excess water prior to loading (e.g., tilting the bucket to drain excess water prior to loading, using buckets equipped with holes, and so forth). The off-road dump trucks will be required to use the haul route along the North Berm Haul Road with turnouts constructed at three strategic locations to avoid backing up and passing of loaded trucks.

Upon dewatering and sediment removal of each active construction zone, confirmatory sampling to ensure that cleanup goals have been achieved will be conducted. The channel invert will then be regraded in accordance with design drawings before the next downstream construction zone is prepared for dewatering. The removable dike structure Portadam will be installed in the channel with tributary curtains on both sides to avoid sediment release in the channel from bottom disturbance. After settling time for any disturbance in the channel around the cofferdam, dewatering of the next construction zone will begin, as the clean zone is regraded and restored.

6.8 SEDIMENT STOCKPILING

A temporary sediment stockpile area will be established in the northwestern portion of the Northern Channel to temporarily store excavated sediments (see [Figure 1-2](#)). The sediment stockpile area, consisting of four stockpile pads of approximately 10,000 square feet each, which will be bermed with sandbags or a soil berm and lined with a 30-mil high-density polyethylene liner (HDPE) or polyvinyl chloride (PVC) liner overlain by a geonet drainage layer, 1 foot of protective granular base material and 16-ounce geotextile fabric to facilitate collection of excess water from the soil and reduce the volume of fines during dewatering of the excavated sediments. The drainage layer will be protected with the first layer of sediment material and an orange warning porous fence material for material handling of additional sediment materials within the sediment stockpile containment area.

The sediments will be brought to the sediment stockpile area via articulating dump trucks and handled with dedicated construction equipment to reduce the sediments moisture content. Approximately 6,000 cubic yards of soil will be temporarily stockpiled in the staging area at any one time. During rainy or windy days, stockpiles may need to be covered with a plastic liner to prevent soil erosion caused by wind or rain. Stockpiling management will not be required for any import materials. Although excavated sediments will primarily be placed in the sediment stockpile area, a minimal amount of excavated soil and debris will also be stockpiled in this area.

6.9 WASTEWATER HANDLING AND DISPOSITION

The surface of the sediment stockpile area will be graded such that water from the designated non-hazardous and California-hazardous waste pads will drain to two separate runoff sumps that will be installed in the respective corner of each area. Water will enter the runoff collection sump and be piped to a retention basin for storage. Excess water that is stored in the retention basin will be periodically pumped into a series of Baker or Frac tanks for sampling before being discharged to the Northern Channel if the wastewater analysis meets the National Pollutant Discharge Elimination System (NPDES) permit or to a POTW if it does not meet the NPDES requirements.

6.10 TRANSPORTATION AND OFF-SITE DISPOSAL

The excavated sediment may need to be treated in the sediment stockpile area in order to meet the treatment, storage and disposal facility acceptance criteria. A paint filter test will be performed on site every 10 loads to determine the presence of free liquids in a representative sample of waste. This method will be used to determine compliance with Title 40 Code of Federal Regulations (CFR), Parts CFR 264.314 and 265.314. A bench-scale test was performed to determine the type and quantity of reagents that need to be mixed with the wet sediment in order to comply with the disposal facility acceptance criteria. Two reagents, namely waste lock polymer material (WLPM) and limekiln dust (LKD) were tested. The results of the bench-scale testing indicated that 0.6 percent of WLPM or 37 percent of LKD were needed in order to pass the paint filter test method. The WLPM can be added using an agricultural spreader followed by disking to mix the wet sediments with WLPM, while the LKD can be spread using conventional construction equipment and mixed with the wet sediments. It should be noted that before adding any reagents, the soil can be handled by conventional equipment to release as much entrapped water as possible.

As already mentioned, the excavated sediments will be characterized in-situ to determine if it is non-hazardous or non-Resource Conservation and Recovery Act (California hazardous) hazardous waste. Results of the in situ sediment sampling will be used to determine the appropriate off-site disposal facility for the material to be sent. For planning purposes, it is estimated that 50 percent of the excavated sediment will be classified as California hazardous waste and 50 percent will be classified as non-hazardous waste.

Material will be loaded onto off-site disposal vehicles by a front-end loader at the sediment stockpile area. The disposal vehicles will be loaded from a dedicated clean loading pad that will be constructed along one side of the excavated sediment stockpile area. Each disposal vehicle will be equipped with liners, tarps, and other appurtenances as required by the Department of Transportation and California hazardous waste regulations. Hazardous waste manifests or non-hazardous waste manifests or bills of lading will be provided for each load of material removed from the site and will be signed by a representative from the Navy. The selected contractor will inspect each hazardous waste truck prior to the disposal vehicle leaving the site. Off-site disposal

vehicles will only be loaded between the hours of 8:00 am and 5:30 pm to minimize any disturbance to NASA operations. Each load will be inspected to ensure that no visible water is present and a paint filter test will be performed on sediment to be loaded at a frequency of 1 test every 10 loads.

6.11 SITE RESTORATION

Site restoration activities will be performed at the completion of excavation and off-site disposal activities. Temporary drainage features and pipe extensions will be removed and the areas will be restored to the pre-construction condition. The footprint of the material handling facilities will be restored to near pre-construction conditions upon disposition of the materials used in construction of the facilities. Due to heavy haul truck traffic during construction, portions of the North Berm Haul Road, Marriage Road, and East Patrol Road may require repair or resurfacing. In addition, the culverts located near the site may need to be repaired and/or cleaned to allow for better drainage.

6.12 DEMOBILIZATION

Following completion of construction activities, temporary facilities and utilities, personnel, equipment and materials will be removed from the site and the support zone areas will be restored. Construction equipment will be cleaned before leaving the site.

7.0 REMEDIAL DESIGN

The remedial design, including the design basis and criteria, design approach, engineering calculations, design drawings, specifications and opinion of probable costs, is provided in this section.

7.1 DESIGN BASIS AND CRITERIA

The design criteria along with the remediation approach ([Section 6.0](#)) provides the basis for the design. The following design criteria has been established for the remedial design:

Site Hydrology:

1. The temporary bypass pipe will be sized to convey an average September 24-hour storm event (defined as a storm in which the average amount of precipitation for September occurs in one 24-hour period).
2. Verify that the proposed pumps have the capability to convey the base flow (3 cubic feet per second [cfs]) in the Northern Channel plus the average September 24-hour storm event through the temporary bypass pipe.
3. A standby portable pump system should be available for predicted storm events greater than the average September 24-hour return storm event that should be a minimum of 100 horsepower capable of pumping 1,500 gallons per minute (gpm) with 10 feet of head.

Channel and Ditches:

1. Upon the conclusion of excavation activities, the ditches and channel will be graded to have the best hydraulic grade slope available (existing is 0.0002).
2. Sediment within the ditches and channel and soil along the channel slopes (first 800-foot section) will be removed until contamination levels meet the Remedial Action Objectives (RAOs).
3. The side slopes of the ditches and channel will be 1.5:1 during and after excavation activities.

Roads and Turnouts:

1. Determine if Marriage Road, Macon Road, and E. Patrol Road can support anticipated truck loading (five-axle, 80-kip load) during construction activities.
2. Limit truck surcharge loading on North Berm Haul Road to maintain a factor of safety of 1.2.
3. Turnout length and radius will be based on the manufacturer's equipment maneuvering performance data.

Sediment Stockpile Area:

1. Excavated sediment will be spread to a maximum of 12-inch-thick lifts.
2. Sump pumps will have an on/off float level switch with high-high/low-low level interlocking controls to the temporary water storage tanks.
3. Sump pump will be sized to dewater the collection/detention basin within 12 hours.
4. Sediment will pass paint filter test prior to off-site disposal
5. Secondary containment will be designed to hold the contents of the largest temporary storage tank, plus the 10-year, 24-hour storm event for the containment area.
6. Sediment stockpile area should have a minimum of 0.5 percent slope toward the sump pump.

Collection/Detention Basin:

1. The basin will be sized to contain the 10-year, 24-hour return storm event for the sediment stockpile area.
2. The basin will be lined with an impervious liner.
3. The side slopes of the basin will be 2:1.

Calculations were performed to verify hydrology, hydraulics, slope stability, road, and detention basin design criteria and are provided in [Appendix H](#).

7.2 DESIGN APPROACH

This section outlines T N & Associates, Inc. and Tetra Tech EC, Inc. (TtEC) team's approach to develop detailed design documents for the contaminated sediments and soils removal project at Site 27. The main focus of the design approach was to develop design documents that provide adequate details to implement the remediation approach presented in [Section 6.0](#). Key design details that are critical to implementation of the remediation approach are presented in the drawings ([Appendix I](#)) and technical specifications ([Appendix J](#)) for this project. A brief discussion of the design approach related to design elements that makeup a major portion of the specifications and drawings is presented below. The intent of this discussion is to elaborate our overall design approach. These design elements include the following:

- Temporary Pipe Bypass System
- Retention capacity of Marriage Road Ditch and North Patrol Road Ditch
- Channel and ditch grade slope
- Slope stability of the berms
- Haul road and turnouts
- Sediment stockpile area

- Secondary containment for Baker tanks
- Stockpile detention basin

The design criteria for each of these elements are discussed in [Section 7.1](#). Further details of the design approach pertaining to each of these elements are provided below. Photographs of the Northern Channel, Marriage Road Ditch, and North Patrol Road Ditch are provided in [Appendix K](#).

7.2.1 Temporary Pipe Bypass System

A topographic survey was conducted as part of the pre-design activities to record existing conditions of the Northern Channel, North Patrol Road Ditch, Marriage Road Ditch, and the debris pile area. The survey encompassed an area of approximately 55 acres and included adjacent embankments, berm and areas contributing surface water run-on into Site 27. This survey data was used in conjunction with rainfall data and additional site-related hydrology data (i.e., site plans relating to stormwater and drainage management facilities, identifying sizes and location of outfalls and receiving waters to the Northern Channel) to determine the average September 24-hour storm event, the 2-year, 24-hour storm event and the 10-year, 24-hour storm event (see [Section 7.3.1](#) for Site Hydrology Evaluation). The design approach for the temporary pipe bypass system, which consists of piping and a pump, involved use of the average September 24-hour storm event to determine pipe and pump size requirements.

7.2.2 Retention Capacity of Marriage Road Ditch and North Patrol Road Ditch

In the event that a storm greater than the average September 24-hour storm were to occur, retention capacity is available in Marriage Road Ditch and North Patrol Ditch to handle these additional flows. Typical cross sections of the ditches generated from survey data were used to determine a representative cross-sectional area of each ditch. These data, along with the approximate length of the ditches, were used to determine the retention capacity of each ditch.

7.2.3 Channel and Ditch Grade Slope

The site topographic survey conducted during pre-design activities included recording elevations at the bottom and slopes of the Northern Channel. AutoCAD version 2005 was used to generate a base map that was used as the baseline drawing for preparing a soil excavation plan. This base map was also used to prepare the final grading design of the Northern Channel, Marriage Road Ditch and North Patrol Road Ditch.

7.2.4 Slope Stability of the Berms

A slope stability analysis was performed to identify potential unstable conditions at the Northern Channel bank during and after removal of the sediments (see [Section 7.3.3](#)). The stability analysis required some geotechnical parameters such as soil shear strength, soil density, and

moisture content. The soil shear strength and density data were obtained by performing geotechnical testing on undisturbed samples collected as part of the pre-design geotechnical investigation activities. The results of the stability analysis and the impacts to the design are discussed in [Section 7.3.3](#).

7.2.5 Haul Roads and Turnouts

The roadways and transportation routes were evaluated to determine if they will be able to support the anticipated construction traffic loading. The on-site transportation route from the sediment removal area on the Northern Channel to the sediment stockpile area would be along the north berm of the Northern Channel, referred to as the North Berm Haul Road. This transportation route and the Northern Channel berm slope stability were evaluated to determine the appropriate road width and turnout radius and length to support the construction traffic comprising mainly of off-road trucks. The Volvo Model A25D 6x6 was assumed, resulting in a road width of 12 feet, turnout radius of 100 feet, and turnout length of 186.47 feet.

The roadways from the sediment stockpile area to the off-site disposal facility were analyzed to determine their adequacy to support the anticipated number and weight of vehicles that will use these roads. The basic method used to measure the impact to the pavement section due to traffic loading involved the use of the equivalent 18-kip single-axle loads (equivalent single-axle loads [ESAL]). This method is developed by the American Association of State Highway and Transportation Officials and used by California Department of Transportation (Caltrans). The evaluation covered three roads, namely Macon Road, Marriage Road and East Patrol Road, which will be used during sediment removal of the two ditches and for hauling contaminated sediments to off-site disposal facilities. The results of the roadway evaluation and the resulting impacts to the design are discussed in [Section 7.3.4](#).

7.2.6 Sediment Stockpile Area

The sediment stockpile area ([Figure 1-2](#)) identified on the drawings is designed to handle approximately 2 weeks of sediments excavation volume for a total of approximately 6,000 cubic yards. The sediment stockpile area was divided into four areas, each capable of handling 1,500 cubic yards. Run-on control will be accomplished by constructing a berm around each area. All expected runoff and excess water from sediment-handling activities will be channeled to the southeast sump, which will be connected to the stockpile retention basin via a 4-inch perforated polyvinyl chloride (PVC) drain pipe. The design incorporates a 1-foot freeboard capable of handling the 10-year, 24-hour rainfall event. The sediment stockpile area was designed to include an impervious layer (30 mil PVC or high-density polyethylene [HDPE] liner) to keep contaminated material separate. The impervious layer will be overlain by a geonet drainage layer, 1 foot of granular material, and 16-ounce geotextile fabric to facilitate drainage. Prior to construction, the area will need to be cleared, grubbed and the 12 inches of topsoil stripped. The

area will need to be regraded to have a slope of 0.5 percent to drain excess water to the sump and then recompacted to 90 percent of maximum dry density.

7.2.7 Detention Basin

The detention basin (see [Figure 1-2](#) for location) was designed to contain the runoff from the sediment stockpile area in addition to the excess water from the wet sediments. The detention basin was designed to have a capacity of 180,000 gallons, which will contain the volume of runoff from the 10-year, 24-hour rainfall event calculated to be 74,800 gallons, as well as the estimated excess water resulting from sediment dewatering activities. Additional on-site capacity (126,000 gallons), in the form of six on-site, aboveground Baker tanks, is included in the design.

7.2.8 Secondary Containment for Baker Tanks

Water runoff from the sediment stockpile area that is collected in the stockpile detention basin will be pumped into 21,000-gallon Baker tanks. The secondary containment area for the six Baker tanks was designed to hold the contents of one tank, plus the 10-year, 24-hour storm event for the containment area. The containment berm was designed to have 5 inches of freeboard (see [Section 7.3.1](#) for Site Hydrology Evaluation).

7.3 ENGINEERING CALCULATIONS

The remedial design effort included the preparation of engineering calculations for hydrology, hydraulics, slope stability, and roads, which are summarized below and provided in [Appendix H](#).

7.3.1 Site Hydrology Evaluation

A hydrology study was performed for the surface water flow into the Northern Channel to aid in the design of a temporary pipe bypass system that will divert flow around the construction remediation zones. This diversion dewatering system is to provide stormwater runoff control and/or retention of the average September 24-hour storm event.

The study included the following steps:

- Identification of the drainage area
- Identification of design storm and monthly rainfall storm events during remedial activities
- Determination of the average September 24-hour rainfall runoff rate in the Northern Channel
- Determination of the 2-year and 10-year 24-hour storm event runoff rates in the Northern Channel
- Determination of the required retention basin capacity to accommodate the 10-year 24-hour storm event for the sediment stockpile area during remedial activities

The drainage area for the study, referred to as the eastern drainage system, is approximately 1,015 acres, consisting of the southwest portion of the National Aeronautics and Space Administration (NASA) Research Park (NRP) area, the Ames Research Center (ARC) facilities next to the base runway, the Eastside/Airfield, and the California Air National Guard (CANG) area. The eastern drainage system begins in the southern portion of the ARC and the CANG. Two drainage structures, serving approximately 15 acres of Caltrans right-of-way, discharge into the system in the southern portion of the airfield. Stormwater from the airfield and the CANG travels north via storm drain lines and overland flow. Overland flow from the northeastern portion of the airfield is collected by a concrete-lined channel, half of which flows toward the storm drain lift station at Building 191, with the other half flowing into the North Patrol Road Ditch. The North Patrol Road Ditch is separated from the Northern Channel by a levee. The southeastern portion of the NRP contributes to the drainage system via a main line that runs along the western portion of the airfield. Several smaller lines feed into the main line from the eastern portion of the ARC. This main line reaches an ultimate size of 36 inches in diameter and feeds to the Building 191 lift station.

Stormwater from the main line, the North Patrol Road Ditch, along with shallow groundwater, discharges into the lift station, which consists of two pumps with a combined capacity of 12,000 gpm. This water is pumped into the Northern Channel and flows off site. Additionally, two 5,000-gpm pumps, located at intermediate points along the North Patrol Road Ditch discharge water directly into the Northern Channel. Therefore, the total peak discharge of the Northern Channel as it leaves Moffett and enters Lockheed Martin property is 22,000 gpm or 49 cfs.

Using the Rational Method (with runoff coefficient, $c = 0.55$, drainage area = 1,015 acres), the 2-year and 10-year, 24-hour return storm flow rate into the Northern Channel were calculated to be 47 cfs and 70 cfs, respectively. The existing pump system at Moffett (totaling 49 cfs) is capable of conveying the 2-year return storm flow rate of 47 cfs. The 2-year return storm event has only occurred twice during the summer months in 127 years. The combined capacity of Marriage Road Ditch and North Patrol Road Ditch is 1,400,000 cubic feet (32.1 acre-feet). These ditches can be used for retention purposes during storm events greater than the average September 24-hour return storm event and can be pumped out with the existing pump system. The average summer total rainfall runoff from June to September is 18.6 acre-feet. The wettest summer month would be September, which would produce 10.7 acre-feet of stormwater runoff with an average flow rate of 5.4 cfs, if rainfall is assumed to occur in one 24-hour period. The baseline flow of the channel is approximately 3 cfs under dry weather conditions (estimated from a field observation by Mike Cowan, Professional Engineer (PE), during the May 3, 2005, site visit). Therefore, the temporary bypass system was designed to operate normally at a pump rate of approximately 3 cfs, but has the capacity to accommodate an additional 5.5-cfs pumping rate during a September storm event.

7.3.2 Hydraulic Design Flow Rates During Construction for Temporary Pipe Bypass Sizing

Hydraulic calculations were performed to evaluate and select the equipment configuration and specifications at specified flow rates and flow length of the Northern Channel temporary pipe bypass system. The hydraulic characteristics of the temporary bypass system are as follows:

- The length of the temporary pipe is approximately 1,200 feet.
- The baseline flow rate of the Northern Channel during dry conditions is 3 cfs (estimated from a field observation by Mike Cowan, PE, during the May 3, 2005, site visit).
- The average September 24-hour storm flow rate of the Northern Channel is 5.5 cfs (see hydrology calculation, [Appendix H](#)).
- For storms larger than the average September 24-hour storm, retention capacity is available in Marriage Road Ditch and North Patrol Road Ditch.

The Hazen-Williams equation was used for closed conduit pipe for determining head losses or pressure drops. The hydraulic review was generated by the Haestad Methods Computer Program (Flowmaster) for capacity check of the pipe, which is in turn used to size the pump.

The analysis showed that for a bypass configuration consisting of steel or aluminum piping and a pump, a 10-inch line with 50-foot pumping head will provide a flow of 5.5 cfs and an 8-inch line with 50-foot pumping head will provide a flow of 3 cfs.

In addition, the analysis showed that for a bypass configuration consisting of a hydraulic inverted siphon/straight pipe through the cofferdam liner (with 2 feet of headwater), an 18-inch line will provide a flow of 5.5 cfs and a 12-inch line will provide a flow of 3 cfs.

The retention volume of Marriage Road Ditch and North Patrol Road Ditch was calculated to be 140,000 and 1,250,000 cubic feet, respectively. The combined retention capacity of the two ditches is 1,400,000 cubic feet.

As a result of the analysis, the following option is recommended:

- Two 8-inch quick connect lines with one pump in operating condition for the baseline flow rate of 3 cfs (1,500 gpm) and a second one on standby to handle the average September 24-hour storm event of 5.5 cfs (2,500 gpm). Alternatively, there could be two 1,500-gpm pumps on standby, in lieu of a 2,500-gpm pump.
- During a major storm event, provide stormwater retention in Marriage Road Ditch and North Patrol Road Ditch with a backup pumping system (a minimum of 100 horsepower capable of pumping 1,500 gpm with 10 feet of head for dewatering).

Several additional calculations were performed to support the design of the detention basin and the secondary containment of the equipment storage area including the following:

- Volume of the detention basin
- Pumping specifications for 12-hour dewatering of the detention basin
- Determination of the minimum height of a secondary containment berm for the equipment storage area

The detention basin was designed to retain the 10-year, 24-hour storm runoff from the four drying pads within the sediment stockpile area. The volume of the detention basin is approximately 24,000 cubic feet (180,000 gallons). It was determined that a pump operating at 250 gpm providing approximately 20 feet of head is required to dewater the detention basin in 12 hours and transfer the water to the Baker tanks at the equipment storage area.

The secondary containment berm around the equipment storage area was designed to retain the volume of one Baker tank (21,000 gallons) and the runoff from a 10-year, 24-hour storm event (3 inches in 24 hours) with 5 inches of freeboard. Based on these criteria, the height of the berm is 12 inches.

7.3.3 Slope Stability

Excavation and de-watering activities at Moffett will be conducted to remove contaminated sediments from the bottom of the Northern Channel. These activities, as well as surcharge loading from dump trucks used in hauling the contaminated sediments, will contribute in destabilizing existing channel slopes. Calculations were performed to evaluate the extent of impact of these activities on the existing slopes and to plan remedial activities for maintaining long-term stability of the slopes.

Conventional two-dimensional limit-equilibrium analyses were performed to investigate the stability of the Northern Channel slopes after the proposed channel sediment excavation. The computer program, STABL for Windows (Geotechnical Software Solutions, 2003), was used to calculate the factors of safety (F.S.) against potential failure. This factor is defined as the ratio of resisting (stabilizing) forces to the driving forces trying to displace the slope. Bishop's Simplified Method using circular slip surfaces was used.

A representative cross section (Section CS 9+25/Transect 2) of the Northern Channel was selected and used in the slope stability analyses. The impact of two different drainage conditions, presence of surcharge (heavy truck) loading, and water level effects were investigated.

During excavation activities, "undrained" conditions exist where surcharge loading may cause pore pressure buildup. A surcharge loading of 3326 pounds per square feet (psf) of ground pressure, which corresponds to the loaded tire load on a 6-wheel hauler (Volvo Model A25D 6x6) weighing 50 tons, was considered in the analysis. The surcharge loading was set at a distance of 1 foot away from the top of the slope. For this condition, a F.S. of 1.8 was computed, which is greater than the F.S. = 1.2 that is considered satisfactory during construction activities.

For evaluating the long-term performance, “drained” conditions were simulated. The computed factors of safety for excavated conditions (using the slope geometry after the proposed sediment removal) and for benched backfilled conditions (fill material placed as buttress) are summarized in the following table.

Drained Condition (C = 420 psf, phi = 20 deg.)	De-watered		Low-water Level	
	Surcharge	No Surcharge	Surcharge	No Surcharge
Excavated Condition	1.26	2.26	1.25	2.48
Benched Backfilled Condition	1.4	2.38	1.38	2.59

The results show that the F.S. for long-term performance is greater than 1 for all cases and greater than 2 when there are negligible surcharge loading. However, in order to achieve a F.S. = 1.5, any surcharge loading should be limited to a maximum ground pressure of 2,000 psf.

The results of the slope stability analysis will be used to select the type of dump trucks and limit the amount of surcharge loading to maintain a minimum F.S. of 1.2 during sediment excavation and other construction activities. The results will also be used to plan remedial activities for long-term stability of the slopes. These activities include buttressing the bottom of the slopes and limiting the amount of surcharge loading to maintain a minimum F.S. of 1.5 for long-term performance.

7.3.4 Road Load Rating Review

Remediation activities at Moffett require the use of heavy truck traffic over local asphalt paved roads. This traffic will consist primarily of end-dump trucks loaded to the maximum weight allowed by California law. A calculation was performed to evaluate the impact of this construction traffic on three existing roads (Macon Road, Marriage Road, and East Patrol Road).

The capacity of these roads was determined using design principles and methodology presented in the Caltrans Highway Design Manual. The evaluation was performed by back calculating the traffic index for each of the roads using the existing thicknesses of the asphalt pavement and aggregate base layers. The traffic index correlates to the number of 18-kip ESAL that is expected in the design life of the pavement. Every ESAL contribute to damaging the pavement. The pavement design life is based on a number of ESAL consistent with the type of traffic expected over a 20-year period. The ESAL attributed to the construction activities were calculated and then compared with the expected lifetime capacity (amount of ESAL) of the existing pavements.

Based on the results of this calculation, construction activities are expected to produce negligible damage to Macon Road (6-inch asphalt layer and 12-inch aggregate base). Marriage Road and East Patrol Road (2-inch asphalt and 12-inch aggregate base) are expected to be severely damaged by end-dump traffic during the construction time frame. These roads were not designed for semi-tractor trailer traffic.

This evaluation identified potential impacts to Marriage Road and East Patrol Road due to construction activities. As a result, repair and maintenance work of these roads will be conducted as needed at the completion of remedial activities.

7.4 DESIGN DRAWINGS

Design drawings and specifications (see [Section 7.5](#)) were developed to support the design effort and will be implemented by the selected contractor during construction. The drawings include excavation and stockpiling plans for the contaminated sediment, drainage control plans for the temporary drainage diversion of the Northern Channel, and proposed final grades for the Northern Channel, Marriage Road Ditch and North Patrol Road Ditch. Design drawings are provided in [Appendix I](#). A list of the drawings is as follows.

Drawing Number	Drawing Description/Title
T-1	Title Sheet and Site Maps
T-2	Index of Drawings
T-3	Abbreviations, Legend and General Notes
C-1	Site Plan
C-2	Existing Topographic Survey
C-3	Erosion Control Plan/Stormwater Management Plan
C-4	Sediment Stockpile Plan
C-5	Construction Zone 1 and 2, Plan and Profile
C-6	Construction Zone 3 and 4, Plan and Profile
C-7	Construction Zone 5 and 6, Plan and Profile
C-8	Construction Zone 7 and 8, Plan and Profile
C-9	Construction Zone 9 and 10, Plan and Profile
C-10	Stockpile Retention Basin Details
C-11	Turnout Details
C-12	Dewatering Details
C-13	Transect Cross Sections 1 through 12
C-14	Transect Cross Sections 13 through 25
C-15	Marriage Road Plan and Profile
C-16	North Patrol Road Plan and Profile
C-17	North Patrol Road Plan and Profile
C-18	Northern Channel Cross Section - Transect Section
C-19	Northern Channel Cross Section - Transect Section

7.5 SPECIFICATIONS

The specifications were developed to support the remedial design and are provided in [Appendix J](#). The specifications provide information on how each element of the design will be implemented and specifies material types, testing, and installation methods, and so forth. A list of the specifications is provided below.

Specification Number	Specification Title
01110	Summary of Work
01310	Administrative Requirements
01320	Construction Progress Documentation
01330	Submittal Procedures
01356	Stormwater Management Measures
01450	Quality Control
01500	Temporary Facilities and Controls
01575	Temporary Environmental Controls
01720	Surveying
02231	Clearing and Grubbing
02300	Earthwork
02620	Subdrainage System
02661	Geosynthetic Products (Geomembrane, Geotextile, Geonet)
02930	Vegetation

8.0 POST-CONSTRUCTION SUBMITTALS

A project closeout report will be prepared by the Contractor following the completion of the field work and demobilization. The report will provide a record of activities conducted under the project, document decisions made regarding work options, and describe the basis for considering the work as completed. The report will include the results of field testing, sampling records, Field Change Requests, and certificates of waste disposal. The report will also provide copies of drawings generated to specify construction activities, a final survey map prepared by a licensed land surveyor, and final as-built drawings.

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TABLES

TABLE 4-1

**FEDERALLY LISTED SPECIES WITH POTENTIAL TO OCCUR
WITHIN THE PROJECT AREA**

Species	Common Name	Breeding/ Flowering Season	Survey Window	Status ¹
Wildlife				
<i>Pelecanus occidentalis</i>	California Brown Pelican	December - August	March - June	E/E
<i>Rallus longirostris obsoletus</i>	California Clapper Rail	March 15 - August	January - April 15	E/E
<i>Laterallus jamaicensis coturniculus</i>	California Black Rail	March 15 - August	January - April 15	--/T
<i>Charadrius alexandrinus nivosus</i>	Western Snowy Plover	March - August	March 1 - August 30	T/--
<i>Sterna antillarum browni</i>	California Least Tern	April - August	March 15 - August 30	E/E
<i>Reithrodontomys raviventris</i>	Salt-marsh Harvest Mouse	March - November	March - October 15	E/E
<i>Oncorhynchus mykiss irideus</i> ²	Central California Coast Steelhead	December 1 - May 31	December 1 - May 31	T/--

Notes¹ Status: Federal/State

E = Endangered

T = Threatened

-- = No listing






² Effects on steelhead are generally avoided by not scheduling work, which could impact steelhead habitat during the window when fish could be present (December 1 through May 31).

Monitoring is an option during breeding season work.

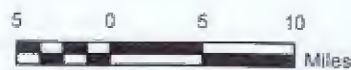
FIGURES



LEGEND

-  STATE HIGHWAY
-  US HIGHWAY
-  INTERSTATE HIGHWAY
-  FORMER NAS MOFFETT FIELD
-  WATER

Source: T1FW, 2005



Scale: 1" = 10 Miles

DATUM: HORIZONTAL - NAD83, VERTICAL - NGVD29



BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
SAN DIEGO, CA

Figure 1-1
VICINITY MAP

FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CA

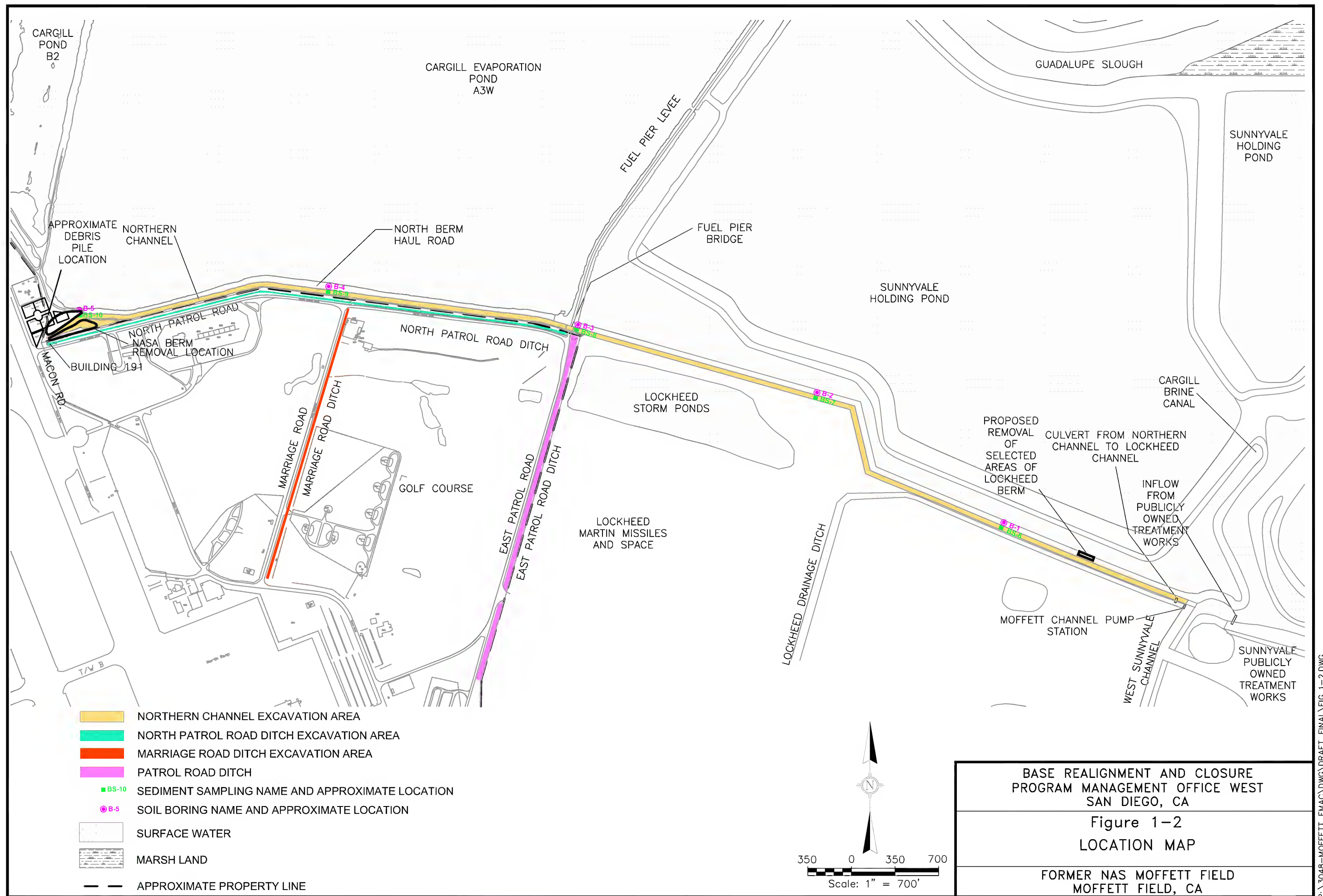
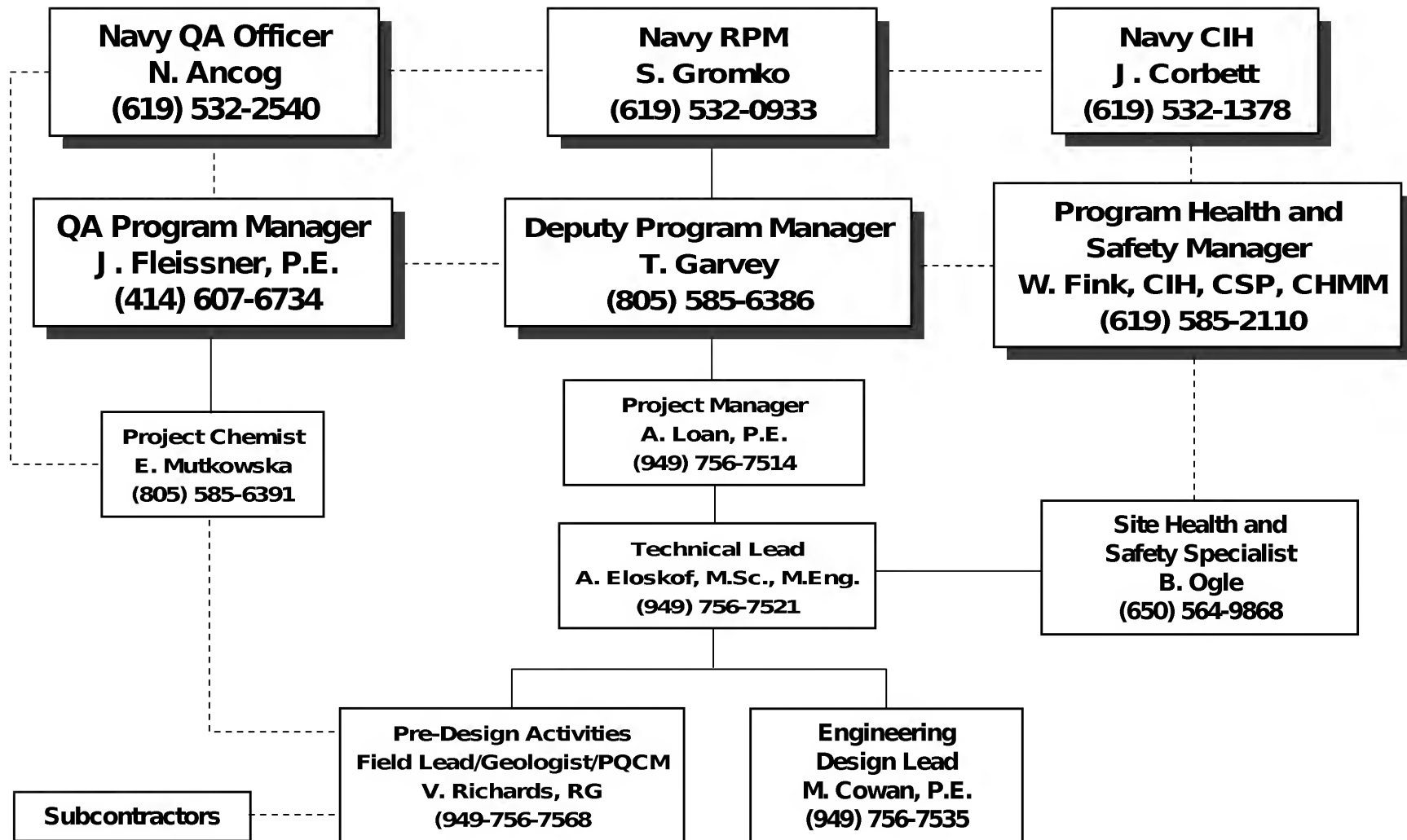


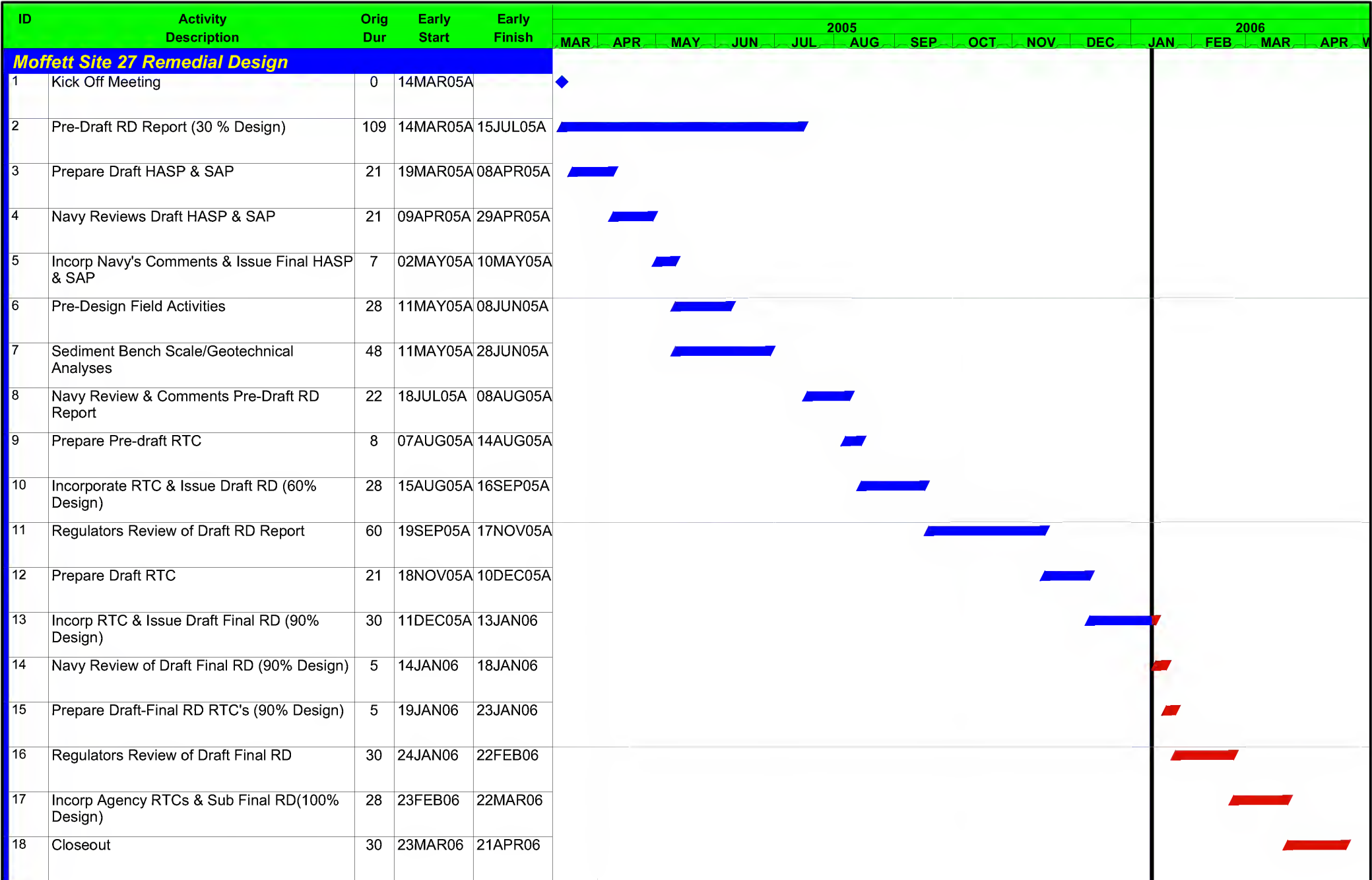
FIGURE 1-3

PROJECT ORGANIZATION CHART



Legend

- - - - - = In regular contact and coordination
- = Directly reports to above



Start Date	14MAR05		Early Bar
Finish Date	21APR06		Progress Bar
Data Date	12JAN06		Critical Activity
Run Date	12JAN06 14:52		

**Figure 1-4
Remedial Design Project Schedule
Moffett Site 27**

APPENDIX A

TRANSPORTATION AND DISPOSAL PLAN

APPENDIX A
DRAFT FINAL
TRANSPORTATION AND DISPOSAL PLAN
FOR
SITE 27
FORMER NAVAL AIR STATION MOFFETT FIELD,
SANTA CLARA COUNTY, CALIFORNIA

ENVIRONMENTAL MULTIPLE AWARD CONTRACT
Contract Number N68711-04-D-1105
Contract Task Order 0002

January 13, 2006

Prepared for



Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Prepared by



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Ventura, California 93001



TETRA TECH EC, INC.

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ATTACHMENTS

[Attachment 1](#) [Truckers' Certification](#)

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Table A.3-1 Potential Off-site Disposal Facility Options

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Figure A.3-1 Transportation Route

ABBREVIATIONS AND ACRONYMS

Caltrans	California Department of Transportation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOT	Department of Transportation
EPA	U.S. Environmental Protection Agency
LDR	land disposal restriction
LTa	lighter-than-air
msl	mean sea level
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NTCRA	non-time-critical removal action
PCB	polychlorinated biphenyl
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
ROICC	Resident Officer in Charge of Construction
TSCA	Toxic Substances Control Act
UHC	underlying hazardous constituent
USFWS	United States Fish and Wildlife Service

1.0 INTRODUCTION

This Transportation and Disposal Plan addresses project-specific information for vehicular traffic control related to the loading and off-site transportation and disposal of wastes and clean backfill material. Wastes included contaminated soil, debris, wastewater, and used personal protection equipment (PPE), generated during the non-time-critical removal action (NTCRA) for polychlorinated biphenyls (PCBs) and metals, located within Site 27 at former Naval Air Station (NAS) Moffett Field (Moffett) in California. This plan pertains specifically to Site 27 that includes the Northern Channel, drainage ditches and associated features located in the northeastern part of Moffett and includes the Patrol Road, North Patrol Road and Marriage Road ditches; berms along the Northern Channel; and a debris pile area located near Building 191. This plan presents environmental mitigation procedures for potentially hazardous soils and non-hazardous soils that will be transported from the site, emergency response procedures, transporter licensing and certification requirements, health and safety compliance, and base regulations. In addition, the locations of major points of ingress and egress at the site and major on-site and off-site roads that will be used by project personnel vehicles and for material transportation from the site will be addressed.

1.1 SITE DESCRIPTION

Moffett is located near the southern end of San Francisco Bay, approximately 35 miles south of San Francisco and 10 miles north of San Jose, California. The facility encompasses about 2,200 acres in Santa Clara County, California.

Moffett was originally commissioned as NAS Sunnyvale in 1933 to support the west coast dirigibles of the lighter-than-air (LTA) program. The Department of the Navy (Navy) operated the facility as NAS Sunnyvale from 1933 to 1935 and again from 1942 to 1994. In 1935, NAS Sunnyvale was transferred to the U.S. Army Air Corps. The U.S. Army Air Corps operated the facility from 1935 to 1942 and used the base for training purposes. In 1939, a permit was granted to Ames Aeronautical Laboratory to use a portion of the base. NAS Sunnyvale returned to Navy control in 1942 and was renamed NAS Moffett Field. Initially supporting the west coast dirigibles of the LTA program, the facility later was used in a variety of aviation-related capacities, which included transport, training, and anti-submarine patrol activities.

NAS Moffett Field was closed as an active military base and the majority of the property was transferred to the National Aeronautics and Space Administration (NASA) on July 1, 1994, under the Base Realignment and Closure program. The facility was renamed Moffett Federal Airfield. The military housing on the base was transferred to the U.S. Air Force and subsequently to the U.S. Army.

Site 27 is located in the northeastern part of Moffett and is part of Operable Unit 6. Site 27 includes the Northern Channel, drainage ditches, and associated features such as:

- Marriage Road Ditch
- Patrol Road Ditch
- North Patrol Road Ditch
- Berms along the Northern Channel
- A debris pile located near the Building 191 lift station

The selected alternative in the Feasibility Study (Tetra Tech EM, Inc., 2003) provides for remedial action of the Northern Channel, the North Patrol Road Ditch, the majority of the Marriage Road Ditch, and the western portion (first 800 linear feet) of the north and south slopes of the Northern Channel, as well as the debris pile. Since there is no action required for the Patrol Road Ditch or the north and south slopes of the Northern Channel east of the first 800 linear feet, they will not be discussed further.

The channel, ditches, berms and debris pile are impacted with PCBs, pesticides and metals. The probable source of contamination for Site 27 is historical surface water runoff. PCB contamination may have originally been introduced into the environment by releases from transformers using oil that contains PCBs. Historically, the Northern Channel has received stormwater runoff from Moffett and NASA Ames Research Center. The portions of the Northern Channel owned by Lockheed Martin Space Systems Company (Lockheed) and Cargill Salt (Cargill) extend eastward approximately 5,500 feet beyond Moffett's boundary. The areas that make up Site 27 that are impacted by the remedial design are described below.

Northern Channel - Historical information regarding Site 27 is incomplete. In the southern portion of San Francisco Bay, several artificial channels were built for navigational purposes. It is uncertain whether the Northern Channel was built for this purpose or if it was constructed as part of the Cargill saltwater evaporation pond system.

Maps from 1932 indicate that the Northern Channel received direct inputs from the former Lindbergh Avenue Ditch, Moffett's original stormwater drainage system, and from a former Moffett septic tank system. Stormwater was diverted to the eastern side of the base when the Moffett runway was extended northward in 1953. The Building 191 lift station was installed to convey water collected in the storm drain system and surface water from the eastern portion of Moffett under the runways to the Northern Channel.

Approximately 10,000 feet long and typically 40 to 50 feet wide, the Northern Channel continuously contains surface water. The bottom of the unlined channel lies approximately 2.8 feet below mean sea level (msl). The channel receives runoff from many of the drainage ditches at Moffett, as well as freshwater input from Building 191 outflow and saltwater input from

groundwater recharge and the Cargill ponds. Water in the channel flows east approximately 1 mile beyond the eastern Moffett boundary and gravity feeds through a pipe to the terminus of the Lockheed Channel, where it is pumped into Moffett Channel, flows to Guadalupe Slough, and eventually reaches San Francisco Bay.

Marriage Road Ditch - The Marriage Road Ditch was built in the 1940s as part of the eastern expansion at Moffett. Located east of the runways, the Marriage Road Ditch divides the Moffett golf course and is approximately 2,300 feet long. The ditch is 5 to 6 feet below msl and portions are lined with a concrete bottom. The Marriage Road Ditch previously received runoff year-round from the East-Side Aquifer Treatment System (approximately 30 gallons per minute), until July 1, 2003, when the treatment system was shut down. In addition, the ditch receives runoff from the golf course, the runways, the east apron area, and the storm drains in the vicinity of Hangars 2 and 3. The Marriage Road Ditch drains into the North Patrol Road Ditch. The ditch provides habitat for insects, worms, snails, and the western pond turtle. Several species of plants grow in and along the sides of the ditch.

North Patrol Road Ditch - Constructed in 1933, this ditch runs 4,300 feet along the North Patrol Road, parallel and south of the Northern Channel. The ditch lies 5.5 feet below msl and the western portion is lined with concrete and generally contains water year-round. It carries surface water runoff from the Marriage Road Ditch, Patrol Road Ditch, and the golf course west to the Building 191 lift station, where it is pumped into the Northern Channel.

Debris Pile - The debris pile is located north of the Building 191 lift station at the west end of the Northern Channel, between the north bank of the channel and south bank of the United States Fish and Wildlife Service (USFWS) ponds, formerly Cargill evaporation ponds. The pile consists of dredged sediments from the Northern Channel, construction debris, and riprap such as broken concrete, asphalt, and other debris left from the 1950s that may have been used to stabilize and prevent erosion of the berm on the west end of the Northern Channel.

Ownership of Site 27 is divided between NASA, Lockheed, and Cargill. Additional interested parties, based on their proximity and/or use of the Northern Channel and the associated berms, include the USFWS and the City of Sunnyvale. In 2003, USFWS purchased the saltwater evaporation ponds adjacent to Site 27 from Cargill. The City of Sunnyvale owns ponds and a publicly owned treatment works facility located near the eastern end of the Northern Channel and also leases a portion of the berms for hiking and biking trails.

2.0 SCOPE OF WORK

The selected prime contractor (contractor) will be awarded a contract for loading the solid waste generated from the Site 27 non-time-critical removal action (NTCRA) and hauling this waste to the appropriate disposal facilities in addition to importing clean backfill material. This Transportation and Disposal Plan specifically addresses regulatory requirements for the transportation and disposal of contaminated sediments, soil, debris, wastewater, used personal protective equipment (PPE), and other wastes associated with the NTCRA for Site 27 to the appropriate disposal facilities and importation of clean backfill material.

If it is determined that Department of Transportation (DOT) hazardous materials will be handled during site remediation activities, based on the previous results of waste characterization analysis, the selected contractor, as well as the subcontracted transporter, will be required to maintain an approved DOT Security Plan that includes in-route security during the transportation of the hazardous waste. The selected contractor will be responsible for soil and sediments excavation, stockpiling, on-site management, waste characterization, and profiling.

The scope of work for this project will include excavation of potentially contaminated material within the subject channels and temporary stockpiling of the excavated sediments and soil on site in a dedicated stockpile area, which will be constructed in accordance with design drawings and specifications. The contaminated soils and sediments will be sampled in situ for waste characterization and subsequently loaded into off-road haul trucks and transported to the waste staging area. Based on the previous characterization results, the sediments will be segregated into non-Resource Conservation and Recovery Act hazardous and non-hazardous and placed on an engineered drainage system, which will be constructed inside bermed and lined containment cells that would allow the sediments to drain. In addition, non-hazardous debris will be removed from the channels, if present, as well as the debris pile and stockpiled in a bermed and lined containment cell.

Waste profiles will be prepared by the selected contractor for the excavated and stockpiled sediments and soils. Multiple profiles may be needed, depending on the waste classification (for instance, Toxic Substances Control Act [TSCA] and/or Resource Conservation and Recovery Act [RCRA]-regulated wastes (RCRA hazardous), non-RCRA hazardous and non-hazardous). The waste classification could potentially require the use of several different disposal facilities. Both Chemical Waste Management in Kettleman City, California, and U.S. Ecology in Beatty, Nevada, are authorized to accept RCRA, non-RCRA, and TSCA waste. If the waste is determined to be RCRA-regulated hazardous waste, then the nature of the underlying hazardous constituents (UHCs) may define the disposal facility to be used. For example, Chemical Waste Management cannot treat pesticide UHCs; however, U.S. Ecology can. Waste materials designated as non-hazardous may be hauled to the Altamont or Forward landfills

located in the cities of Livermore and Stockton respectively, in California. An estimated 65,000 cubic yards of contaminated soil will require loading and hauling to the appropriate landfills. Approximately 65,000 cubic yards of clean import material will be hauled to the Site 27 work area and transported to the channel areas for backfill. Work is anticipated to commence late March 2005 and continue through the end of September 2005.

Adherence to Occupational Safety and Health Administration excavation regulations and permit requirements will be followed at all times. Workers, operators, and drivers will be expected to adhere to site health and safety requirements, as well as to the Site-Specific Health and Safety Plan to be prepared upon the Navy's award of the contract. PPE, including (at a minimum) hard hats, steel-toed boots, safety glasses, and high-visibility vests with reflective stripes, would be required during transportation and disposal activities.

2.1 CONTRACTOR REQUIREMENTS

The prequalified transportation subcontractor would supply all labor, equipment and materials necessary to transport all wastes and import and transport backfill material. The contractor would be required to provide the appropriate means for loading the wastes into the transportation vehicle. Care shall be taken to prevent spillage or leaks during the transfer operation. The contractor and subcontractor will ensure that sufficient spill equipment is on hand during the transfer process.

The subcontractor shall provide the 24-hour emergency contact number during transportation. The contractor may employ one or more transportation subcontractors, provided that they are approved by the Navy, in advance. All drivers must be employees of said subcontractors to ensure hazardous material security. Transportation subcontractors must be approved by the Navy, and the Navy must be informed that they are being used in advance.

The subcontractor shall have all appropriate licenses, medical certifications, permits, and registrations (including but not limited to a Department of Toxic Substances Control hazardous waste transporter registration and a U.S. Environmental Protection Agency [EPA] identification number) for hauling the waste.

The subcontractor shall have a written DOT Hazardous Material Security Plan in effect, and all subcontractor personnel will have been trained as to its requirements. This is in addition to the DOT Hazardous Material Security Plan that the contractor may prepare if it is determined that DOT Hazardous Materials will be shipped.

The subcontractor must provide an on-site truck scale throughout the duration of this project. The truck scale will be located within the vicinity of the temporary waste stockpile and decontamination area,. The scale will be used to ensure that DOT weight restrictions are not exceeded and to provide accurate weights for the waste manifests. The scale is to be used by all

trucks leaving the site with waste. It will be the dual responsibility of the contractor and its transportation subcontractor(s) to document truck weights prior to trucks exiting Moffett.

Drivers will be required to sign a certification ([Attachment 1](#)) acknowledging their understanding of certain policies and procedures concerning site logistics and acknowledging that they meet the appropriate qualifications for the transportation of the waste stream.

3.0 TRANSPORTATION/CIRCULATION

This section provides guidelines and addresses measures for vehicular traffic control during the loading and transportation of stockpiled waste materials and importation of backfill material to and from the Site 27 area. Included is a discussion of the locations of major ingress and egress at Moffett, the effects of construction activities on existing traffic routes, and major on-site and off-site roads that are to be used for waste transporters. This section also discusses major roadways within and outside the vicinity of Moffett, circulation patterns, and volume/numbers of various vehicles that are expected during specific project activities.

3.1 ANALYSIS OF POTENTIAL IMPACTS

Traffic associated with waste hauling activities, such as truck queuing, staging, loading, and leaving the site during implementation of the non-time-critical removal action (NTCRA), will require coordination around other construction-related traffic consisting of trucks delivering equipment and materials, large equipment mobilization, and personnel and support vehicles. The subcontractor will plan and schedule waste and import hauling activities with the prime contractor and the Navy in advance to minimize impacts on traffic in the area. The project team will coordinate all construction activities that may generate traffic with the Resident Officer in Charge of Construction (ROICC) in order to avoid conflicts with other activities being performed concurrently at Moffett. A schedule of proposed truck traffic locations and times will be reviewed with the ROICC during weekly contractor quality control meetings, which are typically held in the prime contractor trailer. During fieldwork, the site will generate approximately 15 site passenger vehicle trips per day during all construction activities, which are estimated to be completed within a total of approximately 180 days. The stated number of vehicles does not include possible visitors. Approximately 75-100 commercial truck trips will be required on the site each day during the waste hauling and backfilling for the duration of the project, which is estimated to be completed in approximately 85 days. The number of trucks includes those used for waste transportation and delivery of backfill materials to the site. Traffic generated by this project will use Highway 101 and will enter Moffett using Ellis Street, which leads to the South Gate. When leaving the Base, the workers will use the same route as they entered.

3.2 TRAFFIC HAUL ROUTE

During construction activities, a truck route will be established such that trucks used for the off-site transportation of waste and import of backfill material will enter Moffett via the South Gate to South Macon Road and follow Macon Road to East Patrol Road and proceed west on North Patrol Road to the Site 27 staging area immediate north of the debris pile area through the North Patrol Road gate (as shown in [Figure A.3-1](#), Transportation Route). Once loaded and appropriately covered and decontaminated, the waste hauling trucks will exit Moffett via the

same route back through the South Gate. Empty import trucks will exit Moffett in the same manner. It anticipated that a maximum of 100 trucks per day will enter Moffett during the height of waste disposal and import activities.

Based on data available from the California Department of Transportation (Caltrans), Highway 101 is designed to handle a maximum of 2,300 vehicles per hour per lane, or a maximum of 441,600 vehicles per day on the stretch of highway relevant to this project. Current usage of the highway, measured during peak hours, is an average of 12,400 vehicles per hour across all (eight) lanes. The current peak month average for daily traffic is 174,000 vehicles per day. The average daily traffic of the highway ramps is as follows: onto southbound Highway 101 from Ellis Street: 4,350 vehicles per day; onto northbound Highway 101 from Ellis Street: 3,850 vehicles per day; onto Ellis Street from northbound Highway 101: 5,103; and onto Ellis Street from southbound Highway 101: 4,850 vehicles per day, respectively.

Based on this data, a maximum traffic increase of 115 vehicles per day over the life of the project associated with field activities at the facility will not affect the existing traffic conditions in the area surrounding Moffett. Within Moffett, the roads that will be used for the project have a minimal traffic density as they are primarily used by service vehicles. Therefore, field activities are not expected to affect the current traffic conditions near the site.

In addition, the schedule for the transportation of waste or import material will be planned to minimize interference with the normal traffic pattern in the area. Trucks will not enter the site before 0700 hours, and main truck hauling activities will be scheduled from 0930 hours to 1530 hours during non-rush hours or low traffic periods. The subcontractor will also stagger their loads, so as to negate the need of a staging area for waiting trucks. If a staging area becomes necessary, trucks will be directed to the East-Side Aquifer Treatment System staging area south of the intersection of Macon Road and Marriage Road. Trucks will enter and exit the facility at the South Gate, which is a short distance from the northbound and southbound Highway 101 on-ramps. The majority of the trucks will have capacities of over 20 tons.

The selected contractor will be informed that approximately 50,000 vehicles enter and exit Moffett each day. It is anticipated that project traffic generated on site will include approximately 15 passenger vehicles per day and a maximum of 100 truck trips per day over the duration of the project. Because the number of trips per day (that is, a maximum of 115 trucks and vehicles per day) is small relative to the daily vehicle traffic, it is anticipated that the additional traffic with appropriate control will not significantly affect Base traffic. Truck traffic will be scheduled to minimize interference with the normal traffic pattern of the Base.

Due to the short duration of construction activities (approximately 180 days), the impact to transportation or traffic patterns is expected to be insignificant. Heavy construction equipment, such as off-road haul trucks, excavators, backhoes, and other support vehicles will remain at the

site for the duration of field activities after initial mobilization. This equipment will not leave the site until such time when they are no longer needed. Vehicles used for commuting workers will be parked in designated areas within the support zone of the project area.

3.3 TRAFFIC SAFETY MEASURES

In order to expedite the passage of traffic through or around the work area and within Moffett, the prime contractor and the transportation subcontractor will install and maintain the necessary signs, lights, temporary railings, barricades, and other facilities for the convenience and direction of facility personnel and tenant traffic, as well as to prevent potentially hazardous conditions from existing. If necessary, during periods of waste or import hauling, the transportation subcontractor will furnish competent flagmen whose sole duties will be to direct the movement of facility traffic through or around the work area and to give adequate warning to facility personnel and tenants of any dangerous conditions to be encountered. Trucks will be required to drive below the speed limit at all times. Flagmen will monitor for speeding trucks, identify these trucks, and prevent them from returning to the site. Further, if speeding trucks are ticketed, they will not be allowed to return to the site. Other measures will include the use of radar guns and the placement of obstacles to slow the trucks. During non-construction periods, non-applicable signs will be covered with black plastic or temporarily removed.

Convenient access to driveways and around the work area will be maintained during construction activities. Water and dust abatement measures will be applied by the prime contractor, as necessary, to the on-site roads used by haul trucks and during loading of trucks for alleviation or prevention of nuisance dust. However, care will be taken to keep the soil unsaturated, which will minimize the accumulation of dirt, mud, or debris that is tracked or dropped onto the roads. All work will be terminated during high wind conditions. A street sweeper, if needed, will also remain at the site for the duration of soil and waste hauling activities to keep the roadways free of soil. In addition, waste hauling trucks will be required to cover their loads, and trucks will be appropriately decontaminated prior to leaving the site. Additional Best Management Practices for construction activities will be enumerated in the Stormwater Management Plan.

3.4 TRAFFIC CONTROLS

Traffic controls will be used to provide for the efficient completion of work activities in a safe working environment, while minimizing the impact to the normal traffic flow. Traffic controls will be required during removal activities in the excavation and stockpile areas to allow for equipment operation and truck loading for off-site transportation. Traffic controls may include, but will not be limited to, the following:

- Traffic flow will be maintained at all times during construction activities on through roads.

- Loading and transportation of wastes will be scheduled in advance and preferably during off-peak hours to minimize disruptions to facility traffic.

All traffic control activities will conform to the applicable specifications of the *Manual of Traffic Control for Construction and Maintenance Work Zones* (Caltrans, 1996) and will be approved by the Navy.

Other project-specific measures that will be used to minimize the impacts of the proposed construction activities include:

- Ensure that proper design geometrics are applied at the access driveways and all internal streets to accommodate trucks and fire apparatus.
- Ensure that truck drivers receive and sign trucker certification (see [Attachment 1](#)). This will consist of a brief tailgate presentation and review of this Transportation and Disposal Plan and emergency response procedures. A signed copy will be kept on site for each truck driver.
- Provide an adequate turning radius on all areas, for example loading areas near soil stockpiles, and so forth.
- Maintain traffic flow at all times on South Macon, East Patrol, and North Patrol roads during project construction phases.
- Provide sufficient area to park all vehicles on site during construction, including parking for haul trucks.
- Maintain close coordination between the Navy, National Aeronautics and Space Administration (NASA), and all other naval facility contractors to ensure safety and to minimize impacts to other activities within the facility.
- Schedule off-road trucks and other transportation trucks removing soil and debris from Site 27 to avoid queuing along major streets. Close coordination between the foreman and the truck dispatcher will be maintained at all times during loading and unloading activities.
- Provide sufficient parking area for all passenger vehicles in the support area and separate from all haul trucks within the fenced portion of support area.
- Use cones, flags, signs, and other traffic control measures, as needed, to facilitate loading and unloading.
- Neither material nor equipment will be stored where it will interfere with the free and safe passage of facility personnel.
- At the end of each day's work and at other times when construction operations are suspended for any reason, the prime contractor and subcontractor(s) will remove all equipment and other obstructions from that portion of the roadway used by facility traffic.
- The prime contractor and subcontractor(s) will adhere to all facility speed limit requirements.

3.5 WASTE TRANSPORTATION AND DISPOSAL

This section describes the disposal methods for the hazardous and non-hazardous waste materials generated at Site 27.

3.5.1 Waste Transportation

Based on waste characterization conducted and waste profiles developed by the prime contractor and approved by the disposal facilities, Toxic Substances Control Act (TSCA), non-Resource Conservation and Recovery Act hazardous and non-hazardous waste soils will be transported by a pre-approved and prequalified transporter. The transporter will have all appropriate licenses and registrations, including but not limited, to a Department of Toxic Substances Control Hazardous Waste Transporter Registration and an U.S. Environmental Protection Agency (EPA) identification number. In addition, drivers will be licensed and will possess a current bi-annual medical certification.

Material that does not exhibit one of the nine Department of Transportation (DOT) hazard classes (for example, explosive, flammable, poison, combustible, and so forth) is not regulated under DOT rules for the transportation of hazardous material. The prime contractor Compliance Officer or the DOT Coordinator will confirm this description prior to shipment.

In the event that hazardous material shipping is required, the applicable DOT shipping description, EPA hazardous waste number, and the California waste code will be selected based on the results of the waste characterization.

In the event that DOT hazardous materials are encountered, the waste will be properly classified, described, packaged, marked, and labeled for shipment, as required by applicable sections of Title 49 Code of Federal Regulations (CFR), Parts 171, 172, 173, 178, and 179, and Title 22 California Code of Regulations, Sections 66262.10 through 66262.45. Properly DOT-trained personnel will perform DOT functions. For waste shipped interstate, the transporter will also require a DOT registration number.

Marking and Labeling - The shipping name, hazard class, identification number, technical names, EPA waste code numbers, and consignee/consignor designations must be marked on non-bulk containers for shipment in accordance with Title 49 CFR, Part 172. Bulk containers are not required to list the DOT description. Examples of marks required on both bulk and non-bulk containers include polychlorinated biphenyl (PCB) marks, if applicable. PCB marks are required to be posted on two opposing sides of each bulk container. The subcontractor will mark all containers, as required, after consultation with the Navy Compliance Officer or DOT Coordinator.

Placarding – Vehicles will be appropriately placarded in accordance with Title 49 CFR, Part 172.

Manifest Requirements – Hazardous and non-hazardous wastes will be shipped off site using the appropriate hazardous or non-hazardous waste manifests. Manifests will be completed by the subcontractor for approval and signature by the Navy before the waste leaves the site. The prime contractor will not sign any copies of manifests for the Navy. Copies of all manifests will be retained in the project files; original copies are sent with the transporter.

The manifest must accompany the waste at all times. When waste is transferred from the custody of the transporter to the designated disposal facility, the new party must sign the manifest and take custody of the waste in accordance with all Resource Conservation and Recovery Act (RCRA), California, and DOT requirements.

Each manifest will list only the transporter(s) and designated disposal/recycling facility that have been prequalified and authorized by the Navy. No changes, including additions or subtractions may be made to the transporter(s) or disposal facility on the manifest without direct authorization from the Navy in advance of the change. The prime contractor must immediately contact the Navy regarding any proposed change to the manifest prior to the change occurring.

The prime contractor must immediately notify the Navy Remedial Project Manager and the ROICC if any discrepancies in a waste shipment are discovered. The transporting subcontractor must attempt to resolve any discrepancies causing rejection of waste with the disposal facilities.

The subcontractor must permit the Navy reasonable time to respond prior to rejection of waste. Under no circumstances will the transporter leave the waste or turn over custody of the waste to anyone without prior direction and approval from the Navy.

The prime contractor will ensure that a copy of each manifest is returned to the Navy Remedial Project Manager within 30 days of receipt of the waste at the designated disposal facility. In addition, Certificates of Treatment/Disposal will be obtained within 30 days from receipt of wastes.

Land Disposal Restriction Certification – Land disposal restriction (LDR) certification will be prepared and will accompany the manifest if applicable. Copies of all LDR certifications will be retained in the project files with the signed manifest received from the disposal facility.

3.5.2 Off-site Disposal

All wastes intended for off-site disposal will be processed according to the final waste classification and approved profile from the intended disposal facility, as coordinated by the ROICC. Disposal may be a combination of options determined by the hazardous classifications as follows:

- Soil, personal protective equipment (PPE), and debris intended for off-site disposal that is classified as a TSCA-regulated, RCRA hazardous, or non-RCRA (California) hazardous waste will be transported to a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Off-site Rule-approved hazardous waste facility for treatment and/or disposal.
- Soil, PPE, and debris intended for off-site disposal that is classified as non-hazardous waste will be transported to a CERCLA Off-site Rule-approved waste facility.
- Wastewater will be characterized and profiled for proper off-site treatment and/or disposal to a CERCLA Off-site Rule-approved waste facility. It should be noted that only wastewater which exceeds the Moffett National Pollutant Discharge Elimination System or publicly owned treatment works permit limits will be hauled off site.

Bulk waste intended for off-site disposal will be loaded onto trucks for transportation to the appropriate off-site disposal facilities. Loaded trucks will be weighed at an on-site truck scale, belonging to the subcontractor, to ensure compliance with DOT regulations. The truck scale will be located in the vicinity of the Site 27 staging area. Appropriate placards will be placed on each transport vehicle, as necessary. In addition, a hazardous waste manifest or non-hazardous waste manifest, as appropriate, will be filled out for each load of bulk and non-bulk waste and submitted to the Navy to sign as generator. Original copies of the manifest will be provided to the transporter for shipment.

Waste will be disposed only at an appropriate waste disposal facility approved by the Navy permitted for the disposal of the particular type of waste generated. The facilities listed in [Table A.3-1](#) may be considered for waste disposal from this project.

Traffic routes from Moffett to CWM Kettleman Hills and Altamont are as follows:

To CWM Kettleman Hills:

- Highway 101 south to
- Highway 152 east to
- I-5 south to Kettleman City

To Altamont:

- Highway 101 south to
- I-880 north to
- SR162 east to
- I-680 north to
- SR 84 east to
- I-580 east to Altamont

3.6 WASTE MINIMIZATION

The following waste minimization techniques will be observed during field activities to reduce the volume of waste generated:

- Do not contaminate materials unnecessarily.
- Do not place media of different hazard classification together.
- Use drop cloths or other absorbent material to contain small spills or leaks.
- Use volume reduction techniques when practicable.
- Verify that waste containers are solidly packed to minimize the number of containers.

4.0 RELEASE PREVENTION, RESPONSE, AND REPORTING

4.1 SPILL PREVENTION

The primary activities that may result in a spill include vehicle fueling and management of decontamination waste. Spill prevention practices for these activities are as follows:

- **Fueling** – Vehicles will be fueled and serviced prior to moving onto the site. On-site fueling of equipment will be conducted within a designated and controlled area. No bulk quantities of fuel will be stored on site.
- **Wastewater** – Wastewater will be stored in temporary retention basins and aboveground tanks within a secondary containment area. Therefore, any spills from the tanks will be contained and will not be released to the surrounding areas.
- **Material Transfer** – Waste transfer operations will only be conducted in areas pre-designated for these activities. Spill equipment will be available.
- **Waste Hauling** – Waste will be properly containerized for transport. As such, liquids will be containerized in drums or in bulk tanker trucks; soil will be placed in roll-off bins or in end-dump trucks and covered securely prior to transport. Personal protective equipment (PPE) will be containerized in drums or will be placed in roll-off bins and covered securely prior to transport. Debris will be placed in end-dump trucks and covered securely prior to transport.

4.2 SPILL RESPONSE

In the event of an on-site release of hazardous materials into the environment, the prime contractor and the subcontractor will contain or control the release or evacuate the area if the spill is significant or represents an immediate health threat. Absorbent pads, shovels, and 55-gallon drums will be kept on site to address the possibility of spills.

In the event of a release or spill of hazardous materials or waste during transport, the prime contractor will be responsible for arranging emergency response. A 24-hour emergency response organization or company shall be contracted by the prime contractor in advance and prepared to respond to incidents that may occur during transport of site wastes.

4.3 SPILL/RELEASE REPORTING

The steps below outline the chain of communications that will be followed if a significant spill of any hazardous substance occurs on site or during transport.

1. Site personnel involved in the spill will immediately contact the Navy Spill/Release On-site Coordinator and National Aeronautics and Space Administration (NASA). At least one of the following Navy individuals will be on site during all remedial activities:

Navy Remedial Project Manager:	Scott Gromko (619) 532-0933
Resident Officer in Charge of Construction (ROICC):	David Smith (650) 603-9836 Gary Munekawa (650) 603-9834

2. If a release of a waste or hazardous substance, regardless of quantity, could threaten human health or the environment outside the facility, the ROICC will verify that the National Response Center [(800) 424-8802] and the local Emergency Response Coordinator (Fire Department, dial 911) have been notified. Additional notifications may apply, depending on the quantity and location of the spill. Releases will be reported, and written follow-up emergency notices will be submitted under the Superfund Amendments Authorization Act, Title II requirements.

4.4 PROJECT AND PERSONNEL REQUIREMENTS

The prime contractor and subcontractor(s) personnel training requirements and inspection programs applicable to the Site 27 non-time-critical removal action are described below.

4.4.1 Personnel Training/Certification Requirements

- All site personnel must have Occupational Safety and Health Administration 40-hour Health and Safety/Emergency Response Hazard Communication and Resource Conservation and Recovery Act waste management training.
- Waste hauler drivers must have a current California driver's license and Hazmat Endorsement.
- Site personnel performing Department of Transportation (DOT) functions, such as selecting, packaging, marking, labeling, preparing shipping papers, and loading wastes, must be trained in accordance with the requirements of HM-126F. Subcontractor(s) performing DOT functions must supply proof of training.
- Site personnel, specifically those who are responsible for loading or transporting DOT hazardous materials must have received DOT hazardous material security training.
- All site personnel performing waste management activities will be trained in accordance with Title 40 Code of Federal Regulation, Part 265.16.
- The Navy will verify subcontractor(s) training records prior to project activities.

5.0 REFERENCES

California Department of Transportation (Caltrans). 1996. *Manual of Traffic Control for Construction and Maintenance Work Zones*.

Tetra Tech EM, Inc., 2003. *Final Northern Channel Feasibility Study (Site 27), Former Naval Air Station Moffett Field, Santa Clara County, California*. November.

TABLES

TABLE A.3-1
POTENTIAL OFF-SITE DISPOSAL FACILITY OPTIONS

Wastestream	Potential Disposal Facility	Facility Location
TSCA (PCB-contaminated) and/or Non-RCRA hazardous soil, PPE, and liners	U.S. Ecology Landfill	Beatty, NV
	Chemical Waste Management, Kettleman Hills Landfill	Kettleman City, CA
RCRA hazardous and TSCA contaminated soil, PPE, and liners	Chemical Waste Management, Kettleman Hills Landfill	Kettleman City, CA
Non-hazardous Wastewater	Altamont Landfill	Livermore, CA
	DKE Environmental	Vernon, CA
Hazardous Wastewater	DKE Environmental	Vernon, CA
	Onyx	Azusa, CA
Non-contaminated Debris/ Non-hazardous Soil	Altamont Landfill	Livermore, CA
	Forward Landfill	Stockton, CA

Notes

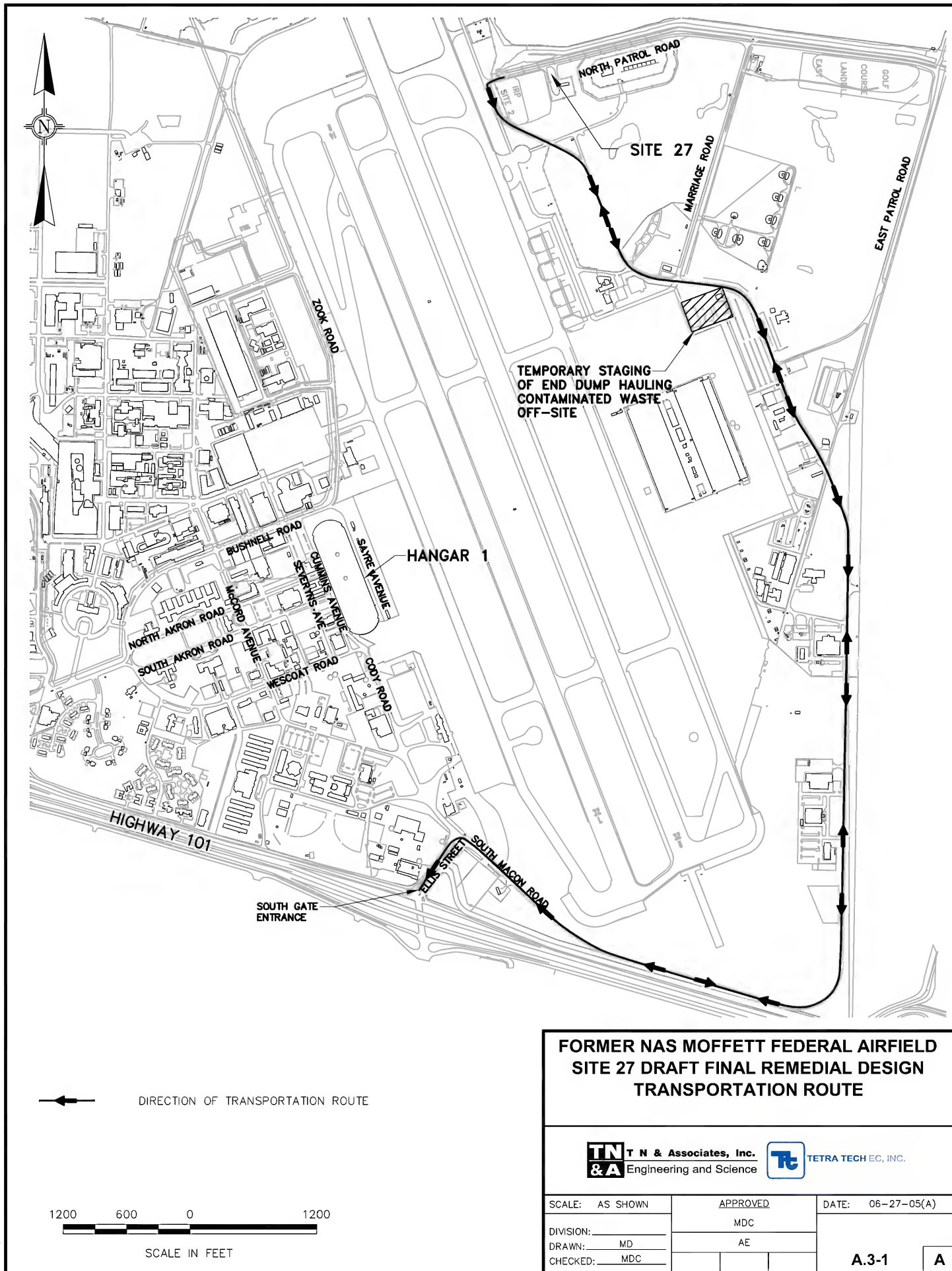
PCB - polychlorinated biphenyl

PPE - personal protective equipment

RCRA - Resource Conservation and Recovery Act

TSCA - Toxic Substances Control Act

FIGURES



← DIRECTION OF TRANSPORTATION ROUTE

1200 600 0 1200
 SCALE IN FEET

ATTACHMENT 1
TRUCKERS' CERTIFICATION

**TRUCKERS' CERTIFICATION****APPROVAL**Approved: ☐Conditionally Approved: ☐Declined: ☐

PESM or Designee Signature: _____

Date: _____

Manager, EHS Services Signature: _____

Date: _____

Restrictions/Comments: _____

I. BACKGROUND INFORMATION:

Company Name: _____

Physical Address: _____

City/State/Zip: _____

Business Address: _____

Contact One: _____

Parent Company: _____

Phone: () _____

EPA ID No (RCRA*): _____

Contact Two: _____

EPA ID No (TSCA) _____

Phone: () _____

USDOT ID No (s): _____

Fax: () _____

Motor Carrier Safety No(s)/ ICC # _____

Previous Name/Owners of
Facility: _____** For Transporters, please provide EPA ID No. for each state in which you
propose transport in or through or attach list.***II. TtEC PROJECT INFORMATION:**

TtEC Contact: _____ Project-Specific waste description/codes: _____

Project: _____

Project Manager: _____

Waste contains hazardous substance: ☐ Yes ☐ No

Charge Number: _____

Project is CERCLA site: ☐ Yes ☐ No

Project Location: _____

TtEC Subcontract or Solicitation No: _____

III. ATTACH VENDOR QUALIFICATION AND DATA QUESTIONNAIRE TO THIS APPROVAL**A completed Vendor Qualification and Data Questionnaire, demonstrating facility's/transporter's service capabilities and waste acceptance criteria should be attached to this approval. This information will be entered into the TtEC National TSDf Database.**



TRUCKERS' CERTIFICATION

IV. HAZARDOUS OR SPECIAL WASTE

Not Applicable: ☐

EPA Region: _____	Date Contacted: _____
Contact and Title: _____	Most Recent Inspection Date: _____
Phone Number: () _____	
Known Releases: _____	
Enforcement Status/Comments: _____	

State Agency/Department: _____	Date Contacted: _____
Contact and Title: _____	Most Recent Inspection Date: _____
Phone Number: () _____	
Known Releases: _____	
Enforcement Status/Comments: _____	

V. TSCA/PCB WASTES

Not Applicable: ☐

EPA Region: _____	Date Contacted: _____
Contact and Title: _____	Most Recent Inspection Date: _____
Phone Number: () _____	
Known Releases: _____	
Enforcement Status/Comments: _____	



TRUCKERS' CERTIFICATION

VI. SOLID/NON-HAZARDOUS WASTES

Not Applicable: ☐

State Agency/Department:	_____	Date Contacted:	_____
Contact and Title:	_____	Most Recent Inspection Date:	_____
Phone Number:	() _____		
Known Releases:	_____		
Enforcement Status/Comments:	_____		

VII. STATE/REGIONAL/LOCAL REQUIREMENTS

Not Applicable: ☐

(Contact Agencies regarding wastewater discharges, air emissions, soil/groundwater contamination, remediation activities and local land use planning approvals, etc.)

Agency/Department:	_____	Date Contacted:	_____
Contact and Title:	_____	Most Recent Inspection Date:	_____
Phone Number:	() _____		
Known Releases:	_____		
Enforcement Status/Comments:	_____		

Agency/Department:	_____	Date Contacted:	_____
Contact and Title:	_____	Most Recent Inspection Date:	_____
Phone Number:	() _____		
Known Releases:	_____		
Enforcement Status/Comments:	_____		



TRUCKERS' CERTIFICATION

VII. STATE/REGIONAL/LOCAL REQUIREMENTS (Continued)

Agency/Department:	_____	Date Contacted:	_____
Contact and Title:	_____	Most Recent Inspection Date:	_____
Phone Number:	()		
Known Releases:	_____		
Enforcement Status/Comments:	_____		

VIII. TRANSPORTATION

Not Applicable: ☐

A. USDOT (www.saferys.org)

USDOT:	_____	Date Contacted:	_____
Contact and Title:	_____	Most Recent Inspection Date:	_____
Phone Number:	()		
Insurance Verified and Up To Date	_____		
DOT Motor Carrier Rating:	_____		
Enforcement Status/Comments:	_____		

B. STATE MOTOR CARRIER

Agency/Department:	_____	Date Contacted:	_____
Contact and Title:	_____	Most Recent Inspection Date:	_____
Phone Number:	()		
Insurance Verified and Up To Date	_____		
Motor Carrier Rating:	_____		
Enforcement Status/Comments:	_____		



TRUCKERS' CERTIFICATION

IX. CERCLA OFF-SITE STATUS - Complete for all facilities		Not Applicable: <input type="checkbox"/> (For transporters only)	
CERCLA Off-Site Coordinator:	_____	Approved to Accept CERCLA waste?	<input type="checkbox"/> Yes <input type="checkbox"/> No
Phone Number:	() _____	Date of CERCLA Approval:	_____
Date Contacted:	_____		
Comments:	_____		

X. TECHNOLOGY - Complete for all facilities		Not Applicable: <input type="checkbox"/> (For transporters only)	
Is Technology Review Required?	<input type="checkbox"/> Yes <input type="checkbox"/> No		
If Yes, Is Technology Review Completed?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Date Completed:	_____

APPENDIX B

STORMWATER MANAGEMENT PLAN

APPENDIX B
DRAFT FINAL
STORMWATER MANAGEMENT PLAN
FOR
SITE 27
FORMER NAVAL AIR STATION MOFFETT FIELD,
SANTA CLARA COUNTY, CALIFORNIA

ENVIRONMENTAL MULTIPLE AWARD CONTRACT
Contract Number N68711-04-D-1105
Contract Task Order 0002

January 13, 2006

Prepared for



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ABBREVIATIONS AND ACRONYMS

ARC	Ames Research Center
BMP	Best Management Practice
CANG	California Air National Guard
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
CWA	Clean Water Act
DWR	Department of Water Resources
gpm	gallons per minute
NASA	National Aeronautics and Space Administration
NPDES	National Pollutant Discharge Elimination System
NRP	NASA Research Park
PE	Project Engineer
PESM	Project Environmental and Safety Manager
PjM	Project Manager
ROD	Record of Decision
RV	recreational vehicle
SS	Site Supervisor
SWMP	Stormwater Management Plan
TN&A	T N & Associates, Inc.
TSS	total suspended solids
TtEC	Tetra Tech EC, Inc.
WB	California Water Board

**REMEDIAL RESTORATION FOR SITE 27
FORMER NAVAL AIR STATION MOFFETT FIELD
STORMWATER MANAGEMENT PLAN**

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

For Tetra Tech EC, Inc.

Name of Certifier: _____

Signature of Certifier: _____

Title of Certifier: Project Manager

Date of Certification: _____

**REMEDIAL RESTORATION FOR SITE 27
FORMER NAVAL AIR STATION MOFFETT FIELD
STORMWATER MANAGEMENT PLAN**

PROFESSIONAL CERTIFICATION

This Stormwater Management Plan (SWMP) was prepared by, or under the direct supervision of, the undersigned, a Registered Civil Engineer (CE-41963) in the state of California, with experience in stormwater runoff, site drainage, and erosion control. The plan contains information generated by the undersigned, as well as information from other sources, which the undersigned believes to be true and accurate.

Signed: _____
Michael Cowan, P.E.

Date: _____

Revision	Date	Signature

1.0 INTRODUCTION

This Stormwater Management Plan (SWMP) presents the measures that will be implemented to minimize sediment and other pollutants in stormwater discharges that may occur during sediment removal within the boundary of the Site 27 Northern Channel at former Naval Air Station Moffett Field (Moffett), Moffett Field, California ([Figure B.1-1](#)). The Final Record of Decision (ROD) for the Site 27 Northern Channel (Base Realignment and Closure Program Management West, 2005) selected sediment removal as the preferred remedy to address human health risk issues related to human exposure. The basis for design and sediment removal is detailed in the Remedial Design Report (T N & Associates, Inc. [TN&A] and Tetra Tech EC, Inc. [TtEC], 2005).

This project is being completed under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authority. Therefore, a National Pollutant Discharge Elimination System permit is not required. However, because the construction area exceeds 1 acre, the substantive conditions of the permit, such as the preparation of a SWMP, must be met.

This SWMP has two major objectives: 1) to help identify the sources of sediment and other pollutants that may affect the quality of stormwater discharges and 2) to describe and ensure the implementation of practices to reduce sediment and other pollutants in stormwater discharges during construction activities. Best Management Practices (BMPs) are presented in [Attachment 1](#) to provide the measures and controls necessary to mitigate potential pollutant sources. Supporting site maps, plans, details, and calculations, along with site-specific inspection and monitoring reporting forms, are provided in the appendices.

This SWMP will be made available to the public for review under Section 308(b) of the Clean Water Act (CWA), and a copy will be provided or made available to the California Water Board (WB) upon request.

1.1 SITE LOCATION

The Site 27 Northern Channel remedial design investigation, along with the restoration of Marriage Road Ditch and North Patrol Road Ditch, will cover approximately 40 acres and is located in the northeastern corner of Moffett ([Figure B.1-2](#)). The Site 27 Northern Channel is located adjacent to North Patrol Road Ditch and north of the Moffett Field Golf Course, which is operated by the United States Air Force. Additional site details and background information are provided in the Remedial Design Report (TN&A and TtEC, 2005).

To the north of the Northern Channel are Northern Channel Berm Road and the northern salt ponds. The southern side of the restoration site is bordered by North Patrol Road. The Marriage

Road Ditch is located immediately south and perpendicular to North Patrol Road. The Marriage Road Ditch is bordered by the golf course.

1.2 SCOPE OF WORK

The major components of the construction activities for restoration to the Site 27 Northern Channel include:

- Construction activities for sediment removal in the Northern Channel, North Patrol Road and Marriage Road ditches
- Managing sediment water flow in the Northern Channel and across the construction work area to prevent additional sediment loading in the Northern Channel and to improve precipitation runoff around the stockpile area in order to reduce sediment into the Northern Channel
- Enacting institutional controls to prevent soil loss or disturbance of excavation materials in the stockpile
- Pre-treatment for total suspended solids (TSS) of dredge sediments dewatering into a retention basin
- Equipment and equipment decontamination pad
- Post-construction and Northern Channel maintenance in the vicinity of the site

The restoration of Site 27 currently includes approximately 65,000 cubic yards of sediment to be excavated.

1.3 PROJECT ORGANIZATION AND POINTS OF CONTACT

Those responsible for implementing and making any necessary revisions to this SWMP comprise the Pollution Prevention Team and consist of the Project Manager (PjM), the Project Engineer (PE), and the Site Supervisor (SS). The PE is responsible for the preparation of and revisions to the SWMP, as well as the selection of BMPs. The SS is responsible for implementation of the SWMP, maintenance of inspection and monitoring records, reporting, and regulatory notification. Oversight of the SWMP implementation will be performed by the PjM.

2.0 SITE CHARACTERISTICS

This section discusses site characteristics, including climate and precipitation, vegetation, and the existing stormwater conveyance system.

2.1 CLIMATE AND PRECIPITATION

The climate in the Northern Channel project area is Mediterranean (National Oceanic and Atmospheric Administration, Division CA-04: Central Coast), with moderate year-round temperatures and a rainy winter season. The SWMP drainage system to be used during construction is designed to control greater than the 2-year, 6-hour rainstorm event. The permanent stormwater drainage controls will be re-established per the original design to accommodate runoff flows from design rainfall event.

The closest long-term precipitation gauge is located at San Jose Station 047821. Between the years 1948 and 2001, the amount of rainfall at that station averaged 14.49 inches per year. Most of this precipitation occurred during the months of October through April, while summers have been relatively dry.

The California Department of Water Resources (DWR) has compiled precipitation frequency data for all of Santa Clara County. The precipitation data have been used in the site's hydrology calculations (see [Appendix H](#) of the Remedial Design Report) for estimating stormwater runoff from the site. A summary of the average rainfall per month over a continuous year period, from 1948 to 1999, is shown in table below (Western Regional Climate Center, 2000).

Based on historical rainfall data at Moffett (Rain Station 745090) for the past 35 years, monthly average precipitation ranges from 0.04 inches in the summer months to 2.62 inches in the winter months. The rainfall duration and intensity during a summer storm event is less than a winter storm event (excluding thunderstorm event with non-uniform concentration over the watershed area). The peak summer event stormwater runoff flow into the Northern Channel (time of concentration greater than 6 hours) could be assumed to be 50 percent to 75 percent less than a winter storm event. Furthermore, the 2-year return storm event has only occurred twice during the summer months in 127 years.

**AVERAGE MONTHLY RAINFALL AT SAN JOSE STATION 047821
SANTA CLARA COUNTY, CALIFORNIA**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Precipitation (inches)	2.83	2.42	2.29	1.12	0.44	0.10	0.02	0.05	0.23	0.70	1.47	2.44

Notes:

Annual average precipitation – 14.49 inches

Source: Western Regional Climate Center, 2000

2.2 VEGETATION

Because the Northern Channel is used as a major drainage course, vegetation in the Site 27 area consists of wetland native species. Four types of trees were identified including willow (*Salix* species), eucalyptus (*Eucalyptus camaldulensis* and *Eucalyptus polyanthemos*), tamarack (*Tamarix*), and pine (*Pinus radiata*).

The remainder of the Northern Channel vegetation consists of grass. Salt grass is the predominant turf in many slope embankment areas.

2.3 EXISTING STORMWATER CONVEYANCE SYSTEM

The existing stormwater hydrology within Ames Research Center (ARC) is in two watershed drainage areas. The ARC watershed consists of about 1,690 acres with an additional 50 acres consisting primarily of Highway 101 right-of-way.

The first drainage area encompasses approximately 680 acres. The drainage system in this area services the National Aeronautics and Space Administration (NASA) Research Park (NRP) area, most of the Ames Campus, Berry Court Military Housing, and the Bay View area. This drainage system is referred to as the western drainage system. The western drainage system discharges into the Stormwater Retention Pond, which lies north of the Bay View area with no outfall and has experienced localized flooding due to inadequate system capacity. This western drainage area will not be part of the site evaluation for site hydrology during the remedial design development.

The second drainage area encompasses approximately 1,015 acres in the southwest portion of the NRP area, the ARC facilities next to the runway, the Eastside/Airfield, and the California Air National Guard (CANG) area. This drainage system is referred to as the eastern drainage system and will be the focus of the Northern Channel drainage control bypass. There is no direct connection between this area and the western drainage area. Local flooding has occurred in the northern part of the eastern drainage system and airfield during peak rainfall events due to the lack of adequate drainage capacity.

The eastern drainage system begins in the southern portion of ARC and the southern portion of the CANG. Two drainage structures, which serve approximately 15 acres of California Department of Transportation's right-of-way, discharge into the southern portion of Moffett. Stormwater from the airfield and the CANG travels north through several storm drain lines and via random overland flow. Overland flow from the northeastern portion of Moffett (currently occupied by the golf course) is collected by a small concrete-lined channel and in Marriage Road Ditch, with half of the drainage flowing toward the Moffett storm drain lift station, which is located at the northeast corner of the airfield. The other half of the drainage flows east to culverts under North Patrol Road and into North Patrol Road Ditch, which is separated from the Northern Channel, by a levee. The levee was raised to prevent flow in the Northern Channel (downstream

of the lift station) from discharging into the smaller channel and flowing back into the lift station. The Northern Channel connects to the easternmost Lockheed pond, adjacent to the Moffett Channel (Sunnyvale West-side Channel), through a 48-inch-diameter culvert. A pump station lifts the water into the Moffett Channel, where it flows by gravity into San Francisco Bay.

2.3.1 Site Hydraulic Design Flows

Existing on-site storm drain pipe sizes throughout ARC range from 6 inches to 42 inches. The southeastern portion of the NRP also contributes to the eastern drainage system via a main line that flows north, near the westernmost portion of the airfield. As this line continues north along Zook Road, it picks up several smaller lines from the eastern portion of ARC. Just south of North Warehouse Road, the line reaches its ultimate size of 36 inches in diameter. This provides a flow capacity of about 40 cubic feet per second (cfs). However, localized flooding has resulted. The 36-inch main line turns east, crossing the airfield, to the Moffett storm drain lift station (Building 191), which is located at the northeastern section of Moffett. The lift station discharges into the Northern Channel, which connects to the easternmost Lockheed pond, adjacent to the Moffett Channel (Sunnyvale West-side Channel), through a 48-inch-diameter culvert. A pump station with three pumps lifts the water into the Moffett Channel, where it flows by gravity into San Francisco Bay.

2.3.2 Northern Channel Pumping Discharge Rates

Stormwater from the 36-inch main and North Patrol Road Ditch, along with shallow groundwater, discharges into the lift station. The lift station at Building 191 consists of two pumps and has a capacity of approximately 12,000 gallons per minute (gpm). Water is pumped into the Northern Channel, which flows east off of the site and runs along the northern boundary of the Lockheed site. Two 5,000-gpm portable pumps are located at intermediate points along North Patrol Road Ditch and discharge directly into the Northern Channel. One pump is located at the Marriage Road and North Patrol Road intersection and the other pump is located at the corner of North Patrol Road and East Patrol Road. Therefore, the total peak discharge into the Northern Channel as it leaves the site is 22,000 gpm or 49 cfs. The Northern Channel connects to the easternmost Lockheed pond, adjacent to the Moffett Channel (Sunnyvale West-side Channel), through a 48-inch-diameter culvert. A pump station with three pumps lifts the water into the Moffett Channel, where it flows by gravity into San Francisco Bay. This pump station serves another 660 acres of land east of ARC and has a total capacity of 31,000 gpm or 69 cfs. To the north of the channel are the Northern Channel berm and the northern salt ponds.

3.0 PLANS FOR CONSTRUCTION

3.1 DEVELOPED STORMWATER CONVEYANCE SYSTEM

The Remedial Action Work Plan (Tetra Tech EC, Inc. [TtEC], 2005) was developed to remove sandy silts in the Northern Channel while limiting any sediment transport in the water flow of the channel. After sediment removal, the Northern Channel invert will be regraded to improve channel drainage. The site improvements will not increase the runoff peak flow rate into the channel.

3.2 CONSTRUCTION IMPLEMENTATION

The remediation action implementation will involve the following key activities:

Task 1 - Site Preparation

The following sections describe the field activities that will be performed in association with site preparation.

- **Mobilization:** mobilization would begin at the end of the rainy season.
- **Setup of field support facilities.** Temporary support facilities will be set up west of the debris pile boundary and north of Building 191.
- **Site surveying.** Prior to sediment excavation activities, a California-licensed land surveyor will survey the existing topographic conditions of the site.
- **Site access control and fencing.** To restrict site access, a temporary chain-link fence may be installed around the stockpile perimeter of the site and two 20-foot truck access gates may be installed at North Patrol Road, along the east and west perimeters of the site.
- **Utility location.** Locate and mark underground utilities where intrusive earthwork will be performed. Also, obtain National Aeronautics and Space Administration (NASA) utility drawings and an Underground Service Alert Dig Alert acceptance.

Task 2 - Construction Control

Erosion and drainage control measures will be implemented in accordance with this construction Stormwater Management Plan (SWMP) before any construction begins. Four floatable sedimentation curtain-type systems will be installed in the Northern Channel during sediment removal downstream of the construction zone. Two 100-horsepower portable tire-mounted diesel water pumps will be on site to divert channel waters around the construction work zone, with one additional unit being only required for backup or for any unusual heavy precipitation storm event. Existing check valves and pumping facilities will be inspected and if maintenance and/or retrofit are needed, it will be provided to accommodate the channel dewatering activities.

Membrane-lined stockpile areas will be developed for sediment removal stockpiling and dewatering. Drainage water for the sediment dewatering will be pre-treated, if needed, for total suspended solids (TSS) in a lined detention basin before pumping into holding tanks for proper testing and ultimate re-routing if it meets the existing National Pollutant Discharge Elimination System or industrial sewer requirements. A lined equipment and truck wash decontamination pad will be made adjacent to the detention basin, which will enable removal of sediments and soil from trucks before leaving the site.

Task 3 - Earthwork

The following sections describe the field activities that will be performed in association with earthwork:

- Field staking. Following construction control implementation and prior to excavation activities, a construction field survey will be performed to establish grade-staking cuts and to survey the top of the clay barrier layer.
- Sediment excavation. The existing sediment in the Northern Channel will be removed in a zone approach. The Northern Channel construction will be subdivided into 10 (1,000-foot) work area zones, designated Construction Zones 1 through 10, which will be used to alternate areas of dewatering, sediment excavation and construction restoration. Excavation activities will be initiated upstream at Construction Zone 1, followed by Construction Zone 2, and finally at the pump facility, which will be Construction Zone 10. Each zone will be dammed and dewatered. The sediments will be excavated and temporarily stockpiled at the on-site stockpile staging area until it is dry enough to remove to the appropriate disposal facilities. Immediately following sediment excavation and removal of each construction zone, the aquatic and riparian restoration construction will be initiated.

In general, the sediment will be excavated to the clay layer. The excavation depth will be completed to either the depth specified by the grade stakes (top of clay layer) or 6 inches below the underlying clay layer, whichever depth leaves an adequate channel bottom drainage grade flow line. Excavation of the sediments and soil will be completed in a dewatered construction zone, with the use of a long-reach excavator to reach across the channel and pull down sediments on the slopes to the bottom of the channel. A 345 CAT excavator will follow behind the long-reach excavator removing the sediment from the bottom of the channel and slope, and load them directly to water-tight off-road haul trucks to transfer wet sediments to the staging area.

Soil Stockpiling

The soil (sediment) will be transported to four designated stockpiles (two hazardous, California hazardous or debris) to be dried out. These stockpile areas will be lined and have a drainage layer on the bottom to collect water. The first two proposed hazardous stockpile areas will be immediately north-northwest of Building 191 in the vacant area between North Patrol Road, Macon Road (recreational vehicle [RV] lot), and the base fence (area measures approximately

100 feet by 200 feet). The second two stockpile areas will be immediately north of the first two stockpiles and immediately south of the RV lot. This location also measures approximately 100 feet by 200 feet. The area, which is south-southeast of Building 191 may be used for staging clean import fill material if needed. All import soil stockpiles could be managed in this area. The material removal stockpile staging area will require approximately 9,000 square feet for each stockpile. The stockpiles will be bermed with soil/sandbags and lined with a minimum 20-mil liner with a geotextile and 12-inch gravel protective drain layer over the liner. A geotextile/geogrid drainage liner may also be used for subdrainage. A sump drain will dewater the soil stockpile into a pre-treatment detention basin before pumping into 20,000-gallon storage Baker tanks for sample testing and appropriate disposal. As wet soil is brought to the stockpile staging area via articulating dump trucks, the soil will be diced, and soil-drying additives may be added. Approximately 5,000 cubic yards of soil may be stockpiled in the staging area before transporting to the appropriate landfill. In the evenings during non-working days and on rainy or windy days, stockpiles may be covered with a plastic liner to prevent soil erosion caused by wind or rain per the construction SWMP. Depending on the results of the bench test, additives may be added to the excavated sediments to expedite the drying process. The additives will be added and mixed with the excavated sediments at the temporary sediments staging areas.

Stockpile management will not be required for any import materials other than the silt fence located downgradient of the project. Appropriate imported fill will be used as needed for clay berm repair or channel bottom replacement.

Northern Channel Drainage Control

The final Northern Channel bottom surface will be designed and graded to maintain a positive slope and manage surface water flow within the channel. In addition, culvert piping may be replaced based on the drainage design to convey stormwater to the channel.

Task 4 - Site Restoration

Due to heavy haul truck traffic during construction, portions of North Patrol Road and East Patrol Road may require repair or resurfacing. In addition, the culverts located near the site may need to be repaired and/or cleaned to allow for better drainage.

A Site Restoration Plan will be developed by a qualified biologist upon completion of vegetation mapping activities scheduled during January 2006. The plan will be a stand-alone document and will be approved by the applicable resource agencies. Representatives from the U.S. Fish and Wildlife Service, California Department of Fish and Game, NASA, and property owners will be invited to accompany the field biologist during vegetation mapping activities.

Task 5 - Final Cleanup and Demobilization

The following field activities will be performed for final cleanup and demobilization.

- Final Survey. A final as-built survey of all surface features, grade flow lines, and culvert/inverts within the Northern Channel will be performed by a licensed California surveyor. The final survey will include all identifiable attributes of the drainage course, including drainage features and pump features. The survey record drawings will be provided in the Closeout Report.
- Demobilization. Demobilization will consist of decontaminating all equipment, removing all construction equipment and temporary facilities, and cleaning the project site.

3.3 CONSTRUCTION SEQUENCE

A construction schedule will be provided in the draft document after consultation with the Navy.

3.4 POTENTIAL SOURCE IDENTIFICATION

Hazardous materials used during the construction phase will include gasoline, diesel fuel, motor oil, hydraulic fluid, cleaners, and various lubricants. There are no feasible alternatives to motor fuels and oils for operating construction equipment. Other materials that may be present also have the potential to impact the environment. Sediments from the Northern Channel itself could potentially impact stormwater that comes into contact with it. To mitigate this, the Northern Channel will have four floatable sedimentation/floating oil curtain-type systems installed in the channel during sediment removal.

There is only minimal potential for environmental impacts from hazardous material incidents during construction. Small volumes of hazardous materials will be temporarily stored on site inside fuel and lubrication service trucks. Other hazardous materials will be stored within secondary containment. Site personnel will be trained on handling these materials. The most likely incidents involving these hazardous materials would be associated with minor spills or drips from heavy equipment usage. Impacts from such incidents will be mitigated by thoroughly cleaning up minor spills as soon as they occur. An incident involving a service vehicle or refueling truck release would present the worst-case scenario for release of hazardous materials. In the case of a large spill of hazardous material, the leak will be stopped if possible. The area will be immediately bermed or contained with a floating oil curtain, followed by blocking of the downgradient release. The hazardous constituents of the spilled material and the volume of the spill will be reviewed by the Site Health and Safety Supervisor and the Project Environmental and Safety Manager (PESM) to determine if any regulatory agency notifications are necessary. A large spill or release cleanup would most likely involve storing the impacted soil and/or materials in drums or roll-off bins or pumping liquids into Baker tanks for off-site disposal or recycling.

4.0 BMPS TO BE IMPLEMENTED FOR CONSTRUCTION ACTIVITIES

Best Management Practices (BMPs) for construction activities are described in the following sections. Detailed descriptions of construction implementation of the BMPs are provided in [Attachment 1](#). Construction activity reference numbers (for example, CA31) can be found in parentheses following the BMPs indicated below. Additional BMPs may be developed as necessary prior to each construction phase. The BMPs for construction are shown in [Figure B.4-1](#) and focus on the following potential pollutant sources:

- Sediment and fine-grained soil (silt) suspended in stormwater runoff
- Fuel, oil, and lubricant spills
- Erosion of soil stockpiles
- Bulk construction material handling

4.1 GOOD HOUSEKEEPING AND MAINTENANCE

Good housekeeping shall include elimination of brush, litter, or other items that may clog drainage devices or enter the stormwater flow from the site. All construction waste shall be disposed in dumpsters, roll-off bins, or other similarly approved containers in designated areas located throughout the site. In addition, sediment trapping/filtering devices will be maintained to ensure that sediment clogging does not take place.

4.2 VEHICLE FUELING (CA31) AND HEAVY EQUIPMENT AND VEHICLE MAINTENANCE (CA32)

4.2.1 Diesel Fuel

During construction activities, diesel fuel will be delivered and pumped directly into the equipment. Delivered diesel fuel will be pumped directly into the heavy equipment, fueling will occur in designated areas that are located away from drainage courses, to prevent the run-on of stormwater and the runoff of spills. The BMP for vehicle fueling (CA31) will be used during on-site fueling activities.

4.2.2 Gasoline

Gasoline used for passenger vehicles and trucks will be obtained from off-site filling stations or on-site storage tanks.

4.2.3 Heavy Equipment

All heavy equipment and site vehicles will be inspected at the beginning and end of each workday for oil and lubricant leaks. Leaking equipment will be repaired or removed from service and small leaks will be cleaned up immediately. All heavy equipment maintenance activities will be performed in designated on-site areas, which will be located away from drainage courses. Excessive greasing of components will be avoided. Accumulated grease will be wiped off and the contaminated rags will be disposed properly off site. All oil and lubricant supplies will be securely stored within containment to prevent an uncontrolled discharge of spilled materials. The BMP for Heavy Equipment and Vehicle Maintenance (CA32) will be used during on-site maintenance activities.

4.2.4 Site Vehicles

Oil changes and maintenance for site vehicles will be performed off site.

5.0 BMPs TO BE IMPLEMENTED FOR EROSION AND SEDIMENTATION CONTROL

Best Management Practices (BMPs) for erosion and sediment control are included in [Attachment 1](#) and will be referenced and implemented as necessary during construction activities. Erosion and sedimentation control reference numbers (for example, ESC1) can be found in parentheses following the BMPs indicated below.

5.1 CONSTRUCTION SEQUENCE (ESC1)

Grading construction will be sequenced to minimize the amount and duration of soil exposed to erosion by wind, rain, runoff, and vehicle tracking.

5.2 PRESERVATION OF EXISTING VEGETATION (ESC2)

The site is and will continue to be the northern drainage course for off-site discharge. Because of this, existing vegetation on the slopes and in the drainage course will be removed from the Northern Channel and along the North Patrol Road and Marriage Road ditches to allow for the sediment removal. Vegetation will be preserved as long as possible to lessen the amount of time that the soils on the slopes are exposed. During construction, the limits of grading or disturbance will be clearly marked in order to segregate this area from areas of preserved vegetation. Initial irrigation and maintenance of revegetation will be the responsibility of the construction contractor. Revegetation planning and response has been addressed in [Section 3.2, Task 4](#).

5.3 TRACKWALKING

During final grading activities of subgrade soil in a particular area, a dozer and/or similar piece of heavy equipment may be used to trackwalk the soil, or drive the equipment up and down the gradient slope. Trackwalking will create tread marks parallel to gradient contours in order to slow stormwater runoff velocity.

5.4 SEEDING AND MULCHING (ESC10)

Following final grade development and ditch grading in a particular area, disturbed vegetated areas will be smoothed, dressed, and hydroseeded as soon as possible with a seed and light fiber mulch mixture.

5.5 GEOSYNTHETICS (ESC20)

Geosynthetic materials may be used around the site to temporarily or permanently stabilize soil, roads, and drains during construction activities for flow line erosion protection.

5.6 DUST CONTROLS (ESC21)

Dust control measures will be used to stabilize soil from wind erosion and reduce dust generated during the following construction activities: clearing and grading, construction vehicle traffic on unpaved roads, sediment tracking onto paved roads, and stockpiling unstabilized soil. A water truck will be used for dust control if necessary. In addition to wet suppression, preventive measures to be used for dust control include minimizing surface areas to be disturbed, limiting on-site vehicular traffic and speed, and controlling the number and activities of vehicles on site at any given time.

5.7 BORROW MATERIAL STOCKPILE AREAS

During grading activities, the northwestern corner of the site will be used to stockpile sediment soil. The soil will be stockpiled in a generally uncompacted condition prior to placement, and will therefore be subject to erosion. In addressing stockpiling, BMPs may include diversion of drainage from the stockpile areas (ESC31), placement of additional sandbag desilting facilities (ESC52) and silt fencing on the downgradient toe of the stockpile slope (ESC50), and dust control (ESC21). In addition, large stockpiles will be sloped to encourage sheet flow and reduce infiltration of rainwater and, if needed, will be covered when not in use.

5.8 DRAINS (ESC54)

All inlets will be protected (ESC54) during construction.

5.9 SILT FENCE AND SANDBAGS (ESC50 AND 52)

Silt fencing and sandbags will be used as sediment trapping/filtering devices downgradient of all disturbed areas where sheet flow occurs. Silt fences will be installed on a level contour receiving no more than 1 acre of runoff per 100 linear feet, or 0.5 cubic feet per second of concentrated flow draining to any point along the silt fence. Sandbags will be installed on level contours receiving drainage areas of up to 5 acres in concentrated flow streams. Locations where the silt fencing and/or sandbags are to be used at the site include:

- Along the berm line on the northern and eastern boundaries of the site
- Around the equipment and material staging area, as well as the soil stockpile area in the western portion of the site, as needed
- Around the 24-inch storm drain located near the northeastern corner of the site
- Along the western, southern, and eastern borders of the site against the chain-link fence that partitions the site

5.10 SEDIMENT TRAP/SPILL CONTAINMENT (ESC55)

During dredge sediment removal stockpiling, a pre-treatment sediment detention basin will be constructed via excavation to provide a detention volume of 20,000 cubic feet for adequate control of sediment-laden drainage waters. The excavated slopes will be lined with a geomembrane and a geotextile liner to protect the slopes from erosion, in addition to the bottom of the basin being lined, which requires infiltration protection. The basin will settle out total suspended solids before pumping the water into Baker holding tanks. All tanks and containers of hazardous materials and waste will be stored in a liner-type secondary containment to prevent potential spills from impacting the environment.

6.0 NON-STORMWATER DISCHARGE MANAGEMENT

Management of non-stormwater discharges will be implemented as part of this Stormwater Management Plan (SWMP). Any non-stormwater discharges will be documented on the appropriate form in [Attachment 2](#). Discharges of non-stormwater for construction usage are authorized only where they do not cause or contribute to a violation of any water quality standard and where they are controlled through the implementation of appropriate Best Management Practices (BMPs). If a non-stormwater discharge is discovered, the SWMP will be revised and BMPs will be implemented to either prevent the discharge or control the discharge so that pollutants are not released. Authorized and unauthorized stormwater discharges for construction activities will be identified in the Remedial Action Work Plan and will be in accordance with the substantive provisions of the U.S. Army Corps of Engineers nationwide permit (NWP 38) (associated with cleanup of hazardous and toxic waste), and the substantive provisions of National Aeronautics Space and Administration's National Pollutant Discharge Elimination System Water Quality Requirements ([Attachment 3](#)) as they apply to discharges into the Northern Channel.

7.0 WASTE MANAGEMENT AND DISPOSAL

Residuals and wastes will be generated by site construction and operation activities. Management of these wastes involves the following steps:

1. Characterization
2. Handling and storage
3. Transportation
4. Disposal or recycling, as appropriate

The most important step, with regards to maintaining compliance with the Stormwater Management Plan, is handling and storage. In order to reduce the potential for and severity of hazardous material spills, all materials and wastes will be stored within lined secondary containment. Portable spill pallets may be used for larger containers such as drums. Smaller containers should be placed within hazardous material storage cabinets with built-in secondary containment. All containers should be protected with a cover or roof to prevent contact with rain or full sun.

Although materials may be stored in larger containers, the smallest containers possible will be used to transfer materials from the storage area to the areas where they will be used. This will help mitigate the potential for larger spills.

7.1 SPILL RESPONSE

If a spill or leak is discovered, it must be immediately cleaned up and the source of the leak repaired. The Project Manager and Project Environmental and Safety Manager will be notified of all spills and releases to determine if they are reportable to regulatory agencies and, if necessary, to notify the Navy of the spill. The Site Supervisor will determine what additional Best Management Practices will need to be implemented to prevent future spills.

If a spill occurs and threatens to contaminate stormwater generated at the site, monitoring and sampling must be conducted as described in [Section 10.2](#).

8.0 IMPLEMENTATION OF OTHER APPROVED PLANS

Several management plans approved by the Navy have been implemented to provide a framework by which the site construction activities are executed. These plans include a Site-Specific Health and Safety Plan and a Work Plan. These plans describe the methods that will be used to execute, integrate, and coordinate emergency response procedures, control quality, address safety and health, and generally perform the work in a sound manner.

9.0 POST-CONSTRUCTION CONTROLS

The post-construction drainage system at the Site 27 Northern Channel will be very similar to the pre-construction drainage system. Minor changes include the following:

- The grading of the existing ditch along the northern boundary of the site to prevent standing water and promote easterly flow of stormwater
- The grading of the Northern Channel to improve drainage

10.0 SITE INSPECTIONS AND MONITORING

10.1 INSPECTIONS

All stormwater management measures and Best Management Practices (BMPs) will be inspected prior to the rainy season and before (prediction of) and following (measurement of) each rain event greater than or equal to 0.25 inches within 24 hours. The inspection will allow for evaluation of the BMPs implemented to prevent the release of potential pollutants. All inspections shall be performed by trained personnel, and the appropriate forms, provided in [Attachment 2](#), shall be filled out. Any BMP inadequacies shall be recorded, modified, and upgraded or repaired as soon as possible. All completed inspection forms shall be retained in the project files.

10.2 MONITORING AND SAMPLING

A major feature of the National Pollutant Discharge Elimination System (NPDES) General Permit is the development and implementation of a monitoring program for stormwater discharges that either discharge directly into sedimentation concern water bodies (303d listed water body) or may contain pollutants, which are not visually detectable in stormwater. Stormwater runoff from the Site 27 Northern Channel will not be discharging directly into a 303d listed water body. However, the potential exists that runoff collected in the detention basin before being pumped into the holding tanks could contain pollutants that are not visible to the eye if a rain event were to occur during a period when soil drying amendments have been added to the sediment in the stockpile area.

In the event that potential runoff pollutants, not visually detectable, exist, samples of stormwater discharge will be taken and sent to a certified state laboratory for analysis. Analytical sampling parameters should be reflective of the NPDES permit requirements. Other construction materials and compounds that are not stored in watertight containers under a watertight roof or inside a building and stockpiled soil amendments are examples of materials for which the contractor may have to implement sampling and analysis procedures.

The goal of sampling and analysis is to determine whether the BMPs employed and maintained on site are effective in preventing potential pollutants from coming in contact with stormwater and causing or contributing to an exceedance of water quality objectives in the receiving waters. Visual observations before, during, and after storm events may trigger the requirement to collect samples. Any breach, malfunction, leakage, or spill observed that could result in the discharge of pollutants, not visually detectable in stormwater, to surface waters shall trigger the collection of a discharge sample. For sites where sampling and analysis are required, personnel trained in water quality sampling procedures shall collect stormwater samples. A sufficiently large sample of stormwater that has not come in contact with the disturbed soil or the materials stored or used

on site (such as an uncontaminated sample) shall be collected for comparison with the discharge sample. Samples shall be collected during the first 2 hours of discharge from rain events that occur during daylight hours and generate runoff. All completed monitoring and sampling forms shall be stored in the project files.

11.0 PERSONNEL TRAINING

All personnel involved with the ongoing monitoring and maintenance of the stormwater management system will attend an annual training class held by the Site Supervisor (SS), or their designee, before the beginning of earthwork construction and/or before the rainy season starting October 1 each year after. The SS will maintain a file of the training documentation. The Stormwater Management Plan program will be reviewed as it relates to the various responsibilities for personnel implementation and awareness.

12.0 SWMP REVIEW AND MODIFICATIONS

This Stormwater Management Plan (SWMP) will be amended, if necessary, to address changes in the physical condition of the site or to maintain compliance in areas where this SWMP is inadequate. Changes to this SWMP will be made with the concurrence of a Professional Engineer registered in the state of California, and the changes will be detailed in the certification section.

13.0 CONSTRUCTION PERMIT NOTICE OF TERMINATION

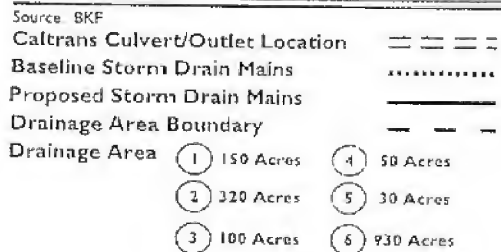
Customarily, a Notice of Termination would be required in order to terminate coverage under the National Pollutant Discharge Elimination System General Permit. However, because this work is being conducted under Comprehensive Environmental Response, Compensation and Liability Act, only the substantive aspects of the permit requirements apply. Therefore, it is not necessary to file a Notice of Termination.

The construction aspect of the project will be considered complete once adequate vegetative ground cover has been established.

14.0 REFERENCES

- Base Realignment and Closure Program Management Office West (2005). *Final Record of Decision, Site 27-Northern Channel*. June.
- Tetra Tech EC, Inc. (TtEC). 2005. Pre-Draft Remedial Action Work Plan. Site 27, Former Naval Air Station Moffett Field, Moffett Field, California. November 2.
- T N & Associates, Inc. (TN&A) and Tetra Tech EC, Inc. (TtEC). 2005. *Draft Remedial Design Report, Site 27*. Former Naval Air Station Moffett Field, Moffett Field, California. September.
- Western Regional Climate Center. 2000. *San Jose, California (047821), Period of Record Monthly Climate Summary*. Available at <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?casjos+nca>.

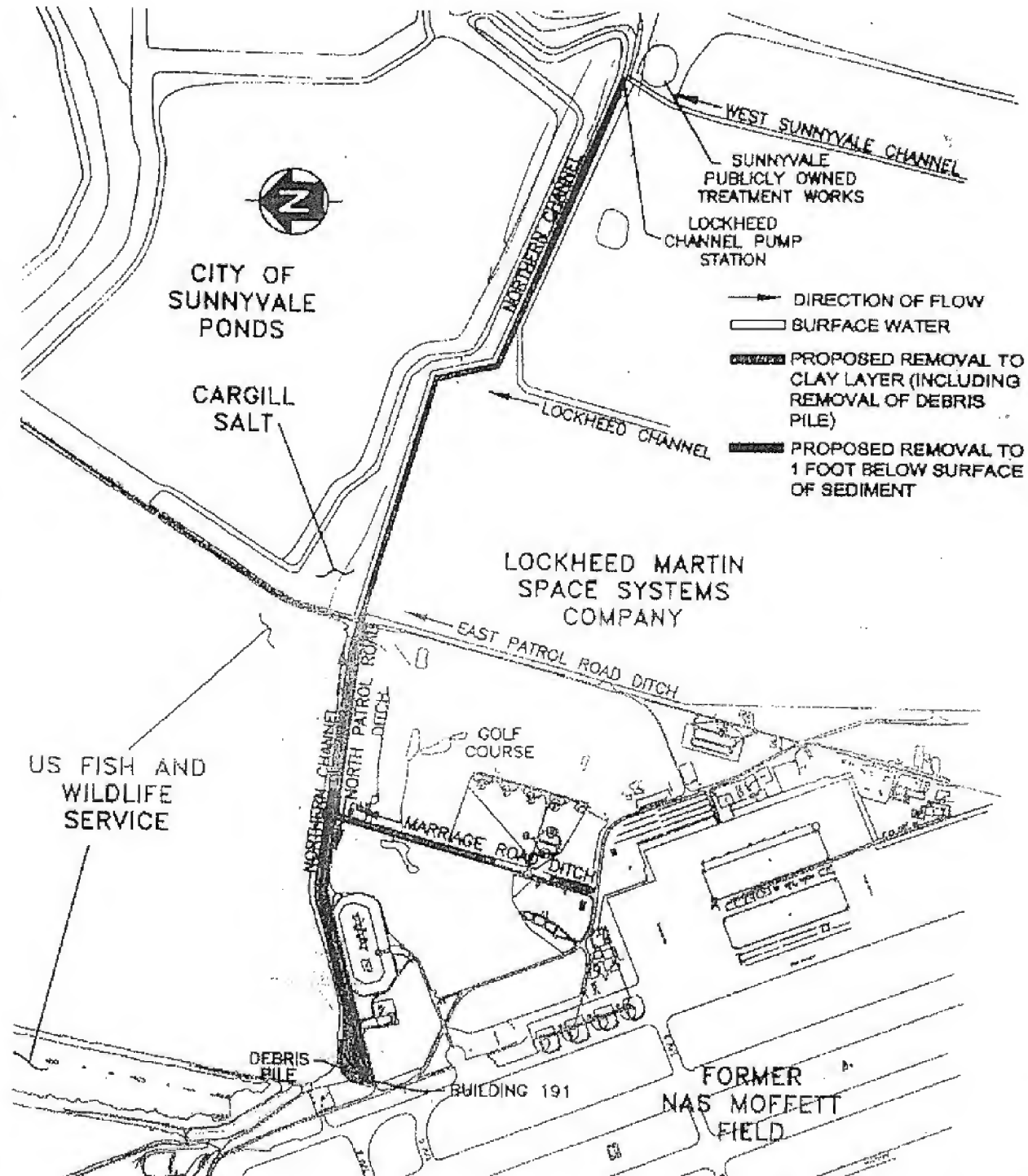
FIGURES



TN **T N & Associates, Inc.**
&A **Engineering and Science**



A



**FORMER NAS MOFFETT FEDERAL AIRFIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
SITE PLAN**

TN & Associates, Inc.
Engineering and Science

TETRA TECH EC, INC.

SCALE: AS SHOWN

APPROVED

DATE: 06-27-05(A)

DIVISION:

MDC

DRAWN: MD

AE

CHECKED: MDC

B.1-2

A

SOURCE: NASA, 2002

DRAWING NUMBER:
C-3

FLOATING TURBIDITY CURTAIN (SEE NOTES AND DETAILS ON SHEET C 12)

NORTHERN CHANNEL

SILT FENCE 3' OFF EDGE ON NORTH BERM HAUL RD. NORTH SIDE

FUEL PIER BRIDGE

SUNNYVALE HOLDING POND

SUNNYVALE HOLDING POND

CARGILL BRINE CANAL

CULVERT FROM NORTHERN CHANNEL TO LOCKHEED CHANNEL

INFLOW FROM PUBLICLY OWNED TREATMENT WORKS

FLOATING TURBIDITY CURTAIN (SEE NOTES AND DETAILS ON SHEET C 12)

MOFFETT CHANNEL PUMP STATION

PROVIDE MAINTENANCE TO GATE/CHECK GATE AND PROTECT INLET AS NEEDED WITH SILT FENCES IN CHANNEL

SUNNYVALE PUBLICLY OWNED TREATMENT WORKS

WEST SUNNYVALE CHANNEL

LEGEND:

- ||||| SILT FENCE
- FLOATING TURBIDITY CURTAIN
- 1" GRAVEL AREA
- DIRECTION OF DRAINAGE FLOW
- SURFACE WATER
- MARSH LAND

NOTES:

1. FLOATING TURBIDITY CURTAIN TO BE RELOCATED ONE ZONE DOWNSTREAM OF CONSTRUCTION ACTIVE ZONE. IT WILL CONSTANTLY BE RELOCATED WITH THE PROGRESS OF EXCAVATION ACTIVITY.
2. A SECOND FLOATING TURBIDITY CURTAIN TO BE LOCATED IN ZONE 10 DOWNSTREAM OF ALL CONSTRUCTION ZONES AT ALL TIMES.
3. AFTER SEDIMENT REMOVAL DITCH MAY BE USED AS A RETENTION BASIN.

350 175 0 350 700
SCALE IN FEET

FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
EROSION CONTROL PLAN/
STORMWATER MANAGEMENT PLAN

TN & Associates, Inc.
Engineering and Science

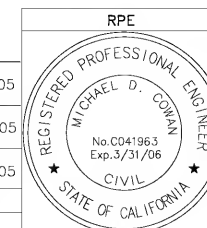
TETRA TECH EC, INC.

SCALE: AS SHOWN
DIVISION: SANTA ANA
DRAWN: MD
CHECKED: HH

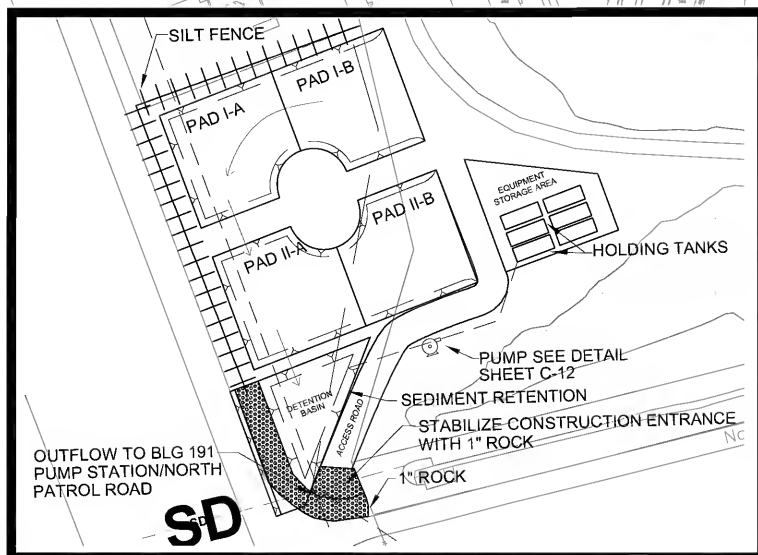
APPROVED
MDC
AE

DATE: 12-15-05 (C)

B.4-1



C	DRAFT FINAL REMEDIAL DESIGN	MDC	MD	HH	MDC	12/15/05
B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



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ATTACHMENT 1

BEST MANAGEMENT PRACTICES

4. SOURCE CONTROL BMPs

INTRODUCTION

This chapter describes specific source control Best Management

Practices (BMPs) for common industrial activities that may pollute storm water. Chapter 2 led you through the steps of identifying activities at your facility that can pollute storm water while Chapter 3 provided guidance on selection of BMPs. This chapter provides you with the BMPs that best fill your facility's need. Best management practices for each of the activities shown below are provided in the following fact sheets.

Each fact sheet contains a cover sheet with:

- A description of the BMP
- Approach
- Requirements
 - Cost, including capital costs, and Operation and Maintenance (O&M)
 - Maintenance (including administrative and staffing)
- Limitations

The side bar presents information on where this BMP applies, targeted constituents, and an indication of the level of effort and cost to implement.

Further information is also provided in additional sheets. This information includes a more detailed description of the BMP, requirements to implement, examples of effective programs, and references.

BMPs are provided for each of the following industrial activities consistent with Worksheet 4 in Chapter 2.

Industrial Activities Requiring BMPs

- SC1 Non-Storm Water Discharges to Drains
- SC2 Vehicle and Equipment Fueling
- SC3 Vehicle and Equipment Washing and Steam Cleaning
- SC4 Vehicle and Equipment Maintenance and Repair
- SC5 Outdoor Loading/Unloading of Materials
- SC6 Outdoor Container Storage of Liquids
- SC7 Outdoor Process Equipment Operations and Maintenance
- SC8 Outdoor Storage of Raw Materials, Products, and By-Products
- SC9 Waste Handling and Disposal
- SC10 Contaminated or Erodible Surface Areas
- SC11 Building and Grounds Maintenance
- SC12 Building Repair, Remodeling, and Construction
- SC13 Over-Water Activities
- SC14 Employee Training

Fact sheet SC14, Employee Training, is a compilation of the training aspects of the individual source control fact sheets. Its purpose is to facilitate the integration and development of a comprehensive training program for all industrial activities at a facility.

ACTIVITY: NON-STORM WATER DISCHARGES TO DRAINS



DESCRIPTION

Eliminate non-storm water discharges to the storm water collection system. Non-storm water discharges may include: process wastewaters, cooling waters, wash waters, and sanitary wastewater.

APPROACH

The following approaches may be used to identify non-storm water discharges:

Visual Inspection

- The easiest method is to inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for three days or more and groundwater may infiltrate the underground storm water collection system.

Piping Schematic Review

- The piping schematic is a map of pipes and drainage systems used to carry wastewater, cooling water, sanitary wastes, etc.
- A review of the "as-built" piping schematic is a way to determine if there are any connections to the storm water collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing

- Smoke testing of wastewater and storm water collection systems is used to detect connections between the two systems.
- During dry weather the storm water collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the storm water system.

Dye Testing

- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the storm water collection system for discoloration.

REQUIREMENTS

Costs (Capital, O&M)

Can be difficult to locate illicit connections especially if there is groundwater infiltration.

LIMITATIONS

Many facilities do not have accurate, up-to-date schematic drawings. TV and visual inspections can identify illicit connections to the storm sewer, but further testing is sometimes required (e.g. dye, smoke) to identify sources.

Applications

Manufacturing

Material Handling

Vehicle Maintenance

Construction

Commercial Activities

Roadways

Waste Containment

Housekeeping Practices

Targeted Constituents

- ☐ Sediment
- ☒ Nutrients
- ☒ Heavy Metals
- ☒ Toxic Materials
- ☐ Floatable Materials
- ☒ Oxygen Demanding Substances
- ☒ Oil & Grease
- ☒ Bacteria & Viruses
- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training

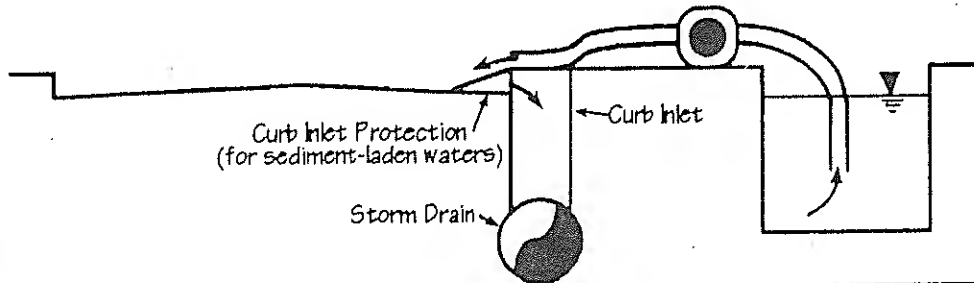
☒ High ☐ Low

SC1



Best Management Practices

ACTIVITY: DEWATERING OPERATIONS



DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from dewatering operations by using sediment controls and by testing the groundwater for pollution.

APPROACH

There are two general classes of pollutants that may result from dewatering operations; sediment, and toxics and petroleum products. A high sediment content in dewatering discharges is common because of the nature of the operation. On the other hand, toxics and petroleum products are not commonly found in dewatering discharges unless, the site or surrounding area has been used for light or heavy industrial activities, or the area has a history of groundwater contamination. The following steps will help reduce storm water pollution from dewatering discharges:

Sediment

- Use sediment controls to remove sediment from water generated by dewatering (See Sediment Trap (ESC 55) and Sediment Basin (ESC 56) in Chapter 5).
- Use filtration to remove sediment from a sediment trap or basin. Filtration can be achieved with:
 - Sump pit and a perforated or slit standpipe with holes and wrapped in filter fabric. The standpipe is surrounded by stones which filters the water as it collects in the pit before being pumped out. Wrapping the standpipe in filter fabric may require an increased suction inlet area to avoid clogging and unacceptable pump operation.
 - Floating suction hose to allow cleaner surface water to be pumped out.

Toxics and Petroleum Products

- In areas suspected of having groundwater pollution, sample the groundwater near the excavation site and have the water tested for known or suspected pollutants at a certified laboratory. Check with the Regional Water Quality Control Board and the local wastewater treatment plant for their requirements for dewatering, additional water quality tests, and disposal options.
- With a permit from the Regional Water Quality Control Board, you may be able to recycle/reuse pumped groundwater for landscape irrigation, or discharge to the storm sewer. With a permit from the local agency, you may be able to treat pumped groundwater and discharge it to the municipal wastewater treatment plant via the sanitary sewer.
- For a quick reference on disposal alternatives for specific wastes, see Table 4.2, CA40, Employee/Subcontractor Training.

Objectives

Housekeeping Practices

Contain Waste

Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion

Targeted Pollutants

- ☒ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☒ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

CA1



CONTRACTOR ACTIVITY: DEWATERING OPERATIONS (Continue)

REQUIREMENTS

- Costs (Capital, O&M)
 - Sediment controls are low cost measures.
 - Treatment and/or discharge of polluted groundwater can be quite expensive.
- Maintenance
 - Maintain sediment controls and filters in good working order. (See Chapter 5 for details)
 - Inspect excavated areas daily for signs of contaminated water as evidenced by discoloration, oily sheen, or odors.

LIMITATIONS

- The presence of contaminated water may indicate contaminated soil as well. See CA22 (Contaminated Soil Management) in this chapter for more information.

REFERENCES

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

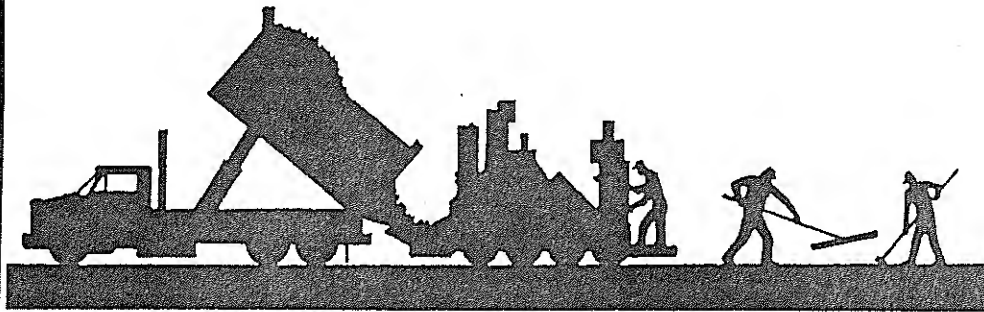
Storm Water Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

CA1



ACTIVITY: PAVING OPERATIONS

Graphic: North Central Texas COG, 1993



DESCRIPTION

Prevent or reduce the discharge of pollutants from paving operations, using measures to prevent runoff and runoff pollution, properly disposing of wastes, and training employees and subcontractors.

APPROACH

- Avoid paving during wet weather.
- Store materials away from drainage courses to prevent storm water runoff (see CA10 Material Delivery and Storage).
- Protect drainage courses, particularly in areas with a grade, by employing BMPs to divert runoff or trap/filter sediment (see Chapter 5).
- Leaks and spills from paving equipment can contain toxic levels of heavy metals and oil and grease. Place drip pans or absorbent materials under paving equipment when not in use. Clean up spills with absorbent materials rather than burying. See CA32 (Vehicle and Equipment Maintenance) and CA12 (Spill Prevention and Control) in this chapter.
- Cover catch basins and manholes when applying seal coat, tack coat, slurry seal, fog seal, etc.
- Shovel or vacuum saw-cut slurry and remove from site. Cover or barricade storm drains during saw cutting to contain slurry.
- If paving involves portland cement concrete, see CA23 (Concrete Waste Management) in this chapter.
- If paving involves asphaltic concrete, follow these steps:
 - Do not allow sand or gravel placed over new asphalt to wash into storm drains, streets, or creeks by sweeping. Properly dispose of this waste by referring to CA20 (Solid Waste Management) in this chapter.
 - Old asphalt must be disposed of properly. Collect and remove all broken asphalt from the site and recycle whenever possible.
 - If paving involves on-site mixing plant, follow the storm water permitting requirements for industrial activities.
- Train employees and subcontractors.

REQUIREMENTS

- Costs (Capital, O&M)
 - All of the above are low cost measures.
- Maintenance
 - Inspect employees and subcontractors to ensure that measures are being followed.
 - Keep ample supplies of drip pans or absorbent materials on-site.

LIMITATIONS

- There are no major limitations to this best management practice.

Objectives

Housekeeping Practices

Contain Waste

- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

Targeted Pollutants

- ☒ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☒ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

CA2



CONTRACTOR ACTIVITY: PAVING OPERATIONS (Continue)

REFERENCES

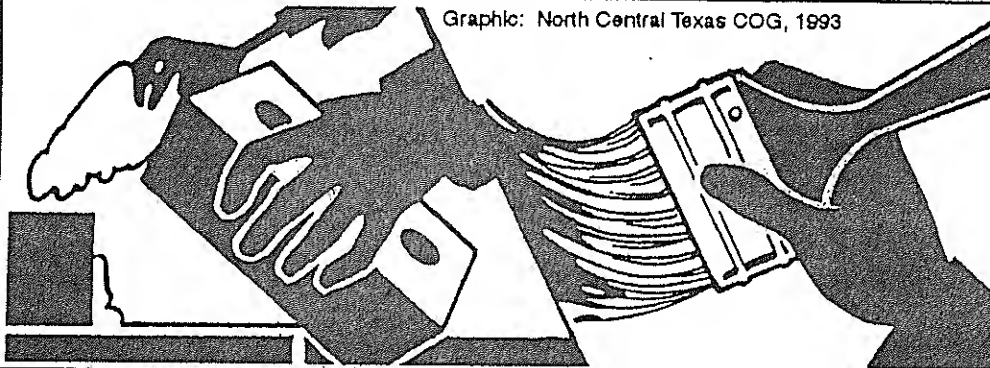
Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

Hot-mix Asphalt Paving Handbook, U.S. Army Corps of Engineers, AC 150/5370-14, Appendix I, July 1991.

CA2



ACTIVITY: STRUCTURE CONSTRUCTION AND PAINTING



Objectives

Housekeeping Practices

Contain Waste

Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion

DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from structure construction and painting by enclosing or covering or berming building material storage areas, using good housekeeping practices, using safer alternative products, and training employees and subcontractors.

APPROACH

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Use soil erosion control techniques if bare ground is exposed (See Chapter 5).
- Buy recycled or less hazardous products to the maximum extent practicable.
- Conduct painting operations consistent with local air quality and OSHA regulations.
- Properly store paints and solvents. See CA10 (Material Delivery and Storage) in this chapter.
- Properly store and dispose waste materials generated from the activity. See the waste management BMPs (CA20 to CA24) in this chapter.
- Recycle residual paints, solvents, lumber, and other materials to the maximum extent practicable.
- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.
- Clean the storm drain system in the immediate construction area after construction is completed.
- Educate employees who are doing the work.
- Inform subcontractors of company policy on these matters and include appropriate provisions in their contract to make certain proper housekeeping and disposal practices are implemented.
- For a quick reference on disposal alternatives for specific wastes, see Table 4.2, CA40, Employee/Subcontractor Training.

REQUIREMENTS

- Costs (Capital, O&M)
 - These BMPs are generally of low to moderate cost.
- Maintenance
 - Maintenance should be minimal.

LIMITATIONS

- Safer alternative products may not be available, suitable, or effective in every case.
- Hazardous waste that cannot be re-used or recycled must be disposed of by a licensed hazardous waste hauler.

Targeted Pollutants

- ☐ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☐ Oil & Grease
- ☒ Floatable Materials
- ☒ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☒ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

CA3



ACTIVITY: STRUCTURE CONSTRUCTION AND PAINTING (Continue)

- Be certain that actions to help storm water quality are consistent with Cal- and Fed-OSHA and air quality regulations.

Construction and painting activities can generate pollutants that can reach storm water if proper care is not taken. The sources of these contaminants may be solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleaners, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos insulation. For specific information on some of these wastes see the following BMPs in this chapter:

CA20 Solid Waste,
CA21 Hazardous Waste, and
CA23 Concrete Waste.

More specific information on structure construction practices is listed below.

Erosion and Sediment Control

If the work involves exposing large areas of soil or if old buildings are being torn down and not replaced in the near future, employ the appropriate soil erosion and control techniques described in Chapter 5.

Storm/Sanitary Sewer Connections

Carefully install all plumbing and drainage systems. Cross connections between the sanitary and storm drain systems, as well as any other connections into the drainage system from inside a building, are illegal. Color code or flag pipelines on the project site to prevent such connections, and train construction personnel.

Painting

Local air pollution regulations may, in many areas of the state, specify painting procedures which if properly carried out are usually sufficient to protect storm water quality. These regulations may require that painting operations be properly enclosed or covered to avoid drift. Use temporary scaffolding to hang drop cloths or draperies to prevent drift. Application equipment that minimizes overspray also helps. When using sealants on wood, pavement, roofs, etc, quickly clean up spills. Remove excess liquid with absorbent material or rags.

If painting requires scraping or sand blasting of the existing surface, use a drop cloth to collect most of the chips. Dispose the residue properly. If the paint contains lead or tributyl tin, it is considered a hazardous waste. Refer to the waste management BMPs in this chapter for more information.

Mix paint indoors, in a containment area, or in a flat unpaved area not subject to significant erosion. Do so even during dry weather because cleanup of a spill will never be 100% effective. Dried paint will erode from sloped surfaces and be washed away by storms. If using water based paints, clean the application equipment in a sink that is connected to the sanitary sewer or in a containment area where the dried paint can be readily removed. Properly store leftover paints if they are to be kept for the next job, or dispose of properly.

Roof work

When working on roofs, if small particles have accumulated in the gutter, either sweep out the gutter or wash the gutter and trap the particles at the outlet of the downspout. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is lined tight, place a temporary plug at the first convenient point in the storm drain and pump out the water with a vacuor truck, and clean the catch basin sump where you placed the plug.

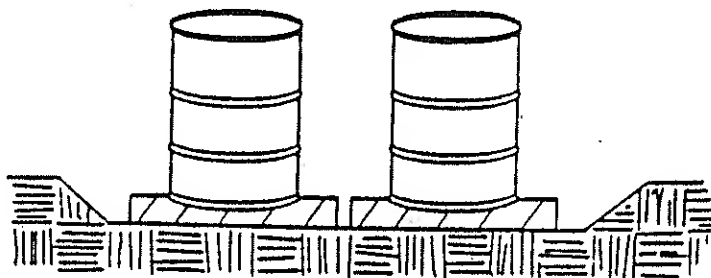
REFERENCES

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

CA3



ACTIVITY: MATERIAL DELIVERY AND STORAGE



DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from material delivery and storage by minimizing the storage of hazardous materials on-site, storing materials in a designated area, installing secondary containment, conducting regular inspections, and training employees and subcontractors.

This best management practice covers only material delivery and storage. For other information on materials, see CA11 (Material Use), or CA12 (Spill Prevention and Control). For information on wastes, see the waste management BMPs in this chapter.

APPROACH

The following materials are commonly stored on construction sites:

- Soil,
- Pesticides and herbicides,
- Fertilizers,
- Detergents,
- Plaster or other products,
- Petroleum products such as fuel, oil, and grease, and
- Other hazardous chemicals such as acids, lime, glues, paints, solvents, and curing compounds.

Storage of these materials on-site can pose the following risks:

- Storm water pollution,
- Injury to workers or visitors,
- Groundwater pollution, and
- Soil contamination.

Therefore, the following steps should be taken to minimize your risk:

- Designate areas of the construction site for material delivery and storage.
 - Place near the construction entrances, away from waterways
 - Avoid transport near drainage paths or waterways
 - Surround with earth berms (see ESC30, Earth Dike.)
 - Place in an area which will be paved
- Storage of reactive, ignitable, or flammable liquids must comply with the fire codes of your area. Contact the local Fire Marshal to review site materials, quantities, and proposed storage area to determine specific requirements. See the Flammable and Combustible Liquid Code, NFPA30.
- For a quick reference on disposal alternatives for specific wastes, see Table 4.2, CA40, Employee/Subcontractor Training.
- Keep an accurate, up-to-date inventory of materials delivered and stored on-site.
- Keep your inventory down.

Objectives

Housekeeping Practices

Contain Waste

- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

Targeted Pollutants

- ☒ Sediment
- ☒ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☒ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☒ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

CA10



ACTIVITY: MATERIAL DELIVERY AND STORAGE (Continue)

- Minimize hazardous materials on-site storage.
- Handle hazardous materials as infrequently as possible.
- During the rainy season, consider storing materials in a covered area. Store materials in secondary containments such as an earthen dike, horse trough; or even a children's wading pool for non-reactive materials such as detergents, oil, grease, and paints. Small amounts of material may be secondarily contained in "bus boy" trays or concrete mixing trays.
- Do not store chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and, when possible, in secondary containment.
- If drums must be kept uncovered, store them at a slight angle to reduce ponding of rainwater on the lids and to reduce corrosion.
- Try to keep chemicals in their original containers, and keep them well labeled.
- Train employees and subcontractors.
- Employees trained in emergency spill cleanup procedures should be present when dangerous materials or liquid chemicals are unloaded.
- If significant residual materials remain on the ground after construction is complete, properly remove materials and any contaminated soil (See CA22). If the area is to be paved, pave as soon as materials are removed to stabilize the soil.

REQUIREMENTS

- Cost (Capital, O&M)
 - All of the above are low cost measures.
- Maintenance
 - Keep the designated storage area clean and well organized.
 - Conduct routine weekly inspections and check for external corrosion of material containers.
 - Keep an ample supply of spill cleanup materials near the storage area.

LIMITATIONS

- Storage sheds often must meet building and fire code requirements.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites; Flood Control District of Maricopa County, AZ, September 1992.

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

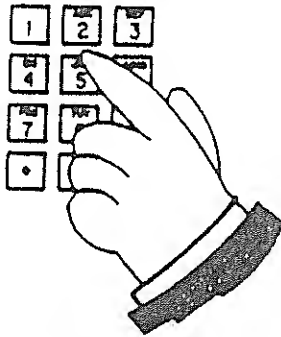
Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

Storm Water Management for Construction Activities; Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

CA10



ACTIVITY: SPILL PREVENTION AND CONTROL



Objectives

Housekeeping Practices

- Contain Waste
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from leaks and spills by reducing the chance for spills, stopping the source of spills, containing and cleaning up spills, properly disposing of spill materials, and training employees.

This best management practice covers only spill prevention and control. However, CA10 (Material Delivery and Storage) and CA11 (Material Use), also contain useful information, particularly on spill prevention. For information on wastes, see the waste management BMPs in this chapter.

APPROACH

The following steps will help reduce the storm water impacts of leaks and spills:

Define "Significant Spill"

- Different materials pollute in different amounts. Make sure that each employee knows what a "significant spill" is for each material they use, and what is the appropriate response for "significant" and "insignificant" spills.

General Measures

- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Train employees in spill prevention and cleanup.
- Designate responsible individuals.

Cleanup

- Clean up leaks and spills immediately.
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to either a certified laundry (rags) or disposed of as hazardous waste.
- Never hose down or bury dry material spills. Clean up as much of the material as possible and dispose of properly. See the waste management BMPs in this chapter for specific information.

Reporting

- Report significant spills to local agencies, such as the Fire Department; they can assist in cleanup.
- Federal regulations require that any significant oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).

Targeted Pollutants

- ☐ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☒ O&M Costs
- ☐ Maintenance
- ☒ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

CA12



ACTIVITY: SPILL PREVENTION AND CONTROL (Continue)

Use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- If maintenance must occur on-site, use a designated area and/or a secondary containment, located away from drainage courses, to prevent the runoff of storm water and the runoff of spills.
- Regularly inspect on-site vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment on-site.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place drip pans or absorbent materials under paving equipment when not in use.
- Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.
- Oil filters disposed of in trash cans or dumpsters can leak oil and pollute storm water. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.
- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- If fueling must occur on-site, use designated areas, located away from drainage courses, to prevent the runoff of storm water and the runoff of spills.
- Discourage "topping-off" of fuel tanks.
- Always use secondary containment, such as a drain pan, when fueling to catch spills/leaks.

REQUIREMENTS

- Costs (Capital, O&M)
 - Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.
- Maintenance
 - Keep ample supplies of spill control and cleanup materials on-site, near storage, unloading, and maintenance areas.
 - Update your spill prevention and control plan and stock cleanup materials as changes occur in the types of chemicals on-site.

LIMITATIONS

- If necessary, use a private spill cleanup company.

REFERENCES

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

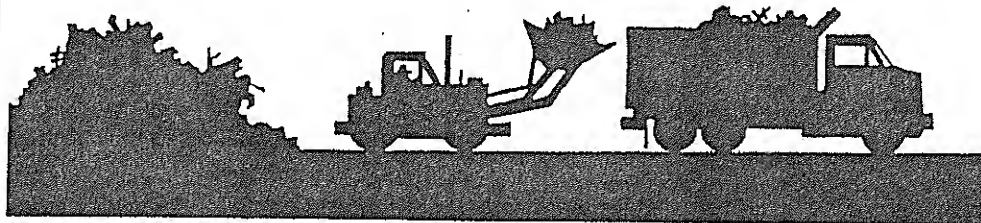
Storm Water Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

CA12



ACTIVITY: SOLID WASTE MANAGEMENT

Graphic: North Central Texas COG, 1993



DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from solid or construction waste by providing designated waste collection areas and containers, arranging for regular disposal, and training employees and subcontractors.

APPROACH

Solid waste is one of the major pollutants resulting from construction. Construction debris includes:

- Solid waste generated from trees and shrubs removed during land clearing, demolition of existing structures (rubble), and building construction;
- Packaging materials including wood, paper and plastic;
- Scrap or surplus building materials including scrap metals, rubber, plastic, glass pieces, and masonry products; and
- Domestic wastes including food containers such as beverage cans, coffee cups, paper bags, and plastic wrappers, and cigarettes.

The following steps will help keep a clean site and reduce storm water pollution:

- Select designated waste collection areas on-site.
- Inform trash hauling contractors that you will accept only water-tight dumpsters for on-site use. Inspect dumpsters for leaks and repair any dumpster that is not water tight.
- Locate containers in a covered area and/or in a secondary containment.
- Provide an adequate number of containers with lids or covers that can be placed over the container to keep rain out or to prevent loss of wastes when it's windy.
- Plan for additional containers and more frequent pickup during the demolition phase of construction.
- Collect site trash daily, especially during rainy and windy conditions.
- Erosion and sediment control devices tend to collect litter. Remove this solid waste promptly.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Salvage or recycle any useful material. For example, trees and shrubs from land clearing can be used as a brush barrier (see ESC53), or converted into wood chips, then used as mulch on graded areas (see ESC11).
- Do not hose out dumpsters on the construction site. Leave dumpster cleaning to trash hauling contractor.
- Arrange for regular waste collection before containers overflow.

Objectives

Housekeeping Practices

Contain Waste

Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion

Targeted Pollutants

- ☒ *Sediment*
- ☐ *Nutrients*
- ☐ *Toxic Materials*
- ☐ *Oil & Grease*
- ☒ *Floatable Materials*
- ☒ *Other Construction Waste*

- ☒ *Likely to Have Significant Impact*
- ☐ *Probable Low or Unknown Impact*

Implementation Requirements

- ☐ *Capital Costs*
- ☐ *O&M Costs*
- ☒ *Maintenance*
- ☒ *Training*
- ☐ *Suitability for Slopes >5%*

- ☒ *High*
- ☐ *Low*

CA20

Best Management Practices

ACTIVITY: SOLID WASTE MANAGEMENT (Continue)

- If a container does spill, clean up immediately.
- Make sure that construction waste is collected, removed, and disposed of only at authorized disposal areas.
- Train employees and subcontractors in proper solid waste management.
- For a quick reference on disposal alternatives for specific wastes, see Table 4.2, CA40, Employee/Subcontractor Training.

REQUIREMENTS

- Costs (Capital, O&M)
 - All of the above are low cost measures.
- Maintenance
 - Collect site trash daily.
 - Inspect construction waste area regularly.
 - Arrange for regular waste collection.

LIMITATIONS

- There are no major limitations to this best management practice.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites; Flood Control District of Maricopa County, AZ, September 1992.

Processes, Procedures, and Methods to Control Pollution Resulting from all Construction Activity; USEPA, 430/9-73-007, 1973.

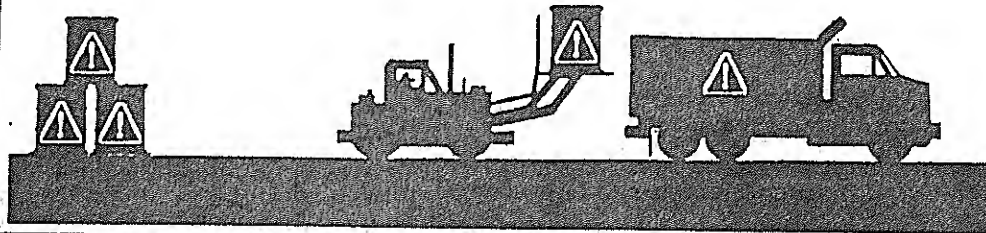
Storm Water Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

CA20



ACTIVITY: HAZARDOUS WASTE MANAGEMENT

Graphic: North Central Texas COG, 1993



Objectives

Housekeeping Practices

Contain Waste

Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion

DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from hazardous waste through proper material use, waste disposal, and training of employees and subcontractors.

APPROACH

Many of the chemicals used on-site can be hazardous materials which become hazardous waste upon disposal. These wastes may include:

- Paints and solvents;
- Petroleum products such as oils, fuels, and grease;
- Herbicides and pesticides;
- Acids for cleaning masonry; and
- Concrete curing compounds.

In addition, sites with existing structures may contain wastes which must be disposed of in accordance with Federal, State, and local regulations. These wastes include:

- Sandblasting grit mixed with lead-, cadmium-, or chromium-based paints;
- Asbestos; and
- PCBs (particularly in older transformers).

The following steps will help reduce storm water pollution from hazardous wastes:

Material Use

- Use all of the product before disposing of the container.
- Do not remove the original product label, it contains important safety and disposal information.
- Do not over-apply herbicides and pesticides. Prepare only the amount needed. Follow the recommended usage instructions. Over-application is expensive and environmentally harmful. Apply surface dressings in several smaller applications, as opposed to one large application, to allow time for infiltration and to avoid excess material being carried off-site by runoff. Do not apply these chemicals just before it rains. People applying pesticides must be certified in accordance with Federal and State regulations.
- Do not clean out brushes or rinse paint containers into the dirt, street, gutter, storm drain, or stream. "Paint out" brushes as much as possible. Rinse water-based paints to the sanitary sewer. Filter and re-use thinners and solvents. Dispose of excess oil-based paints and sludge as hazardous waste.

Targeted Pollutants

- ☐ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☒ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

CA21



ACTIVITY: HAZARDOUS WASTE MANAGEMENT (Continue)

Waste Recycling/Disposal

- Select designated hazardous waste collection areas on-site.
- Hazardous materials and wastes should be stored in covered containers and protected from vandalism.
- Place hazardous waste containers in secondary containment.
- Do not mix wastes, this can cause chemical reactions, make recycling impossible, and complicate disposal.
- Recycle any useful material such as used oil or water-based paint.
- Make sure that toxic liquid wastes (used oils, solvents, and paints) and chemicals (acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Arrange for regular waste collection before containers overflow.
- Make sure that hazardous waste (e.g., excess oil-based paint and sludges) is collected, removed, and disposed of only at authorized disposal areas.
- For a quick reference on disposal alternatives for specific wastes, see Table 4.2, CA40, Employee/Subcontractor Training.

Training

- Train employees and subcontractors in proper hazardous waste management.
- Warning signs should be placed in areas recently treated with chemicals.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- If a container does spill, clean up immediately.

REQUIREMENTS

- Costs (Capital, O&M)
 - All of the above are low cost measures.
- Maintenance
 - Inspect hazardous waste receptacles and area regularly.
 - Arrange for regular hazardous waste collection.

LIMITATIONS

- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.

REFERENCES

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

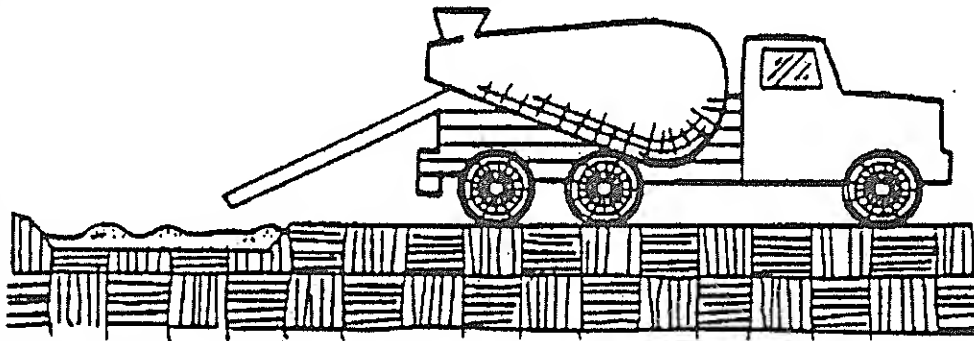
Processes, Procedures, and Methods to Control Pollution Resulting from all Construction Activity; USEPA, 430/9-73-007, 1973.

Storm Water Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

CA21



ACTIVITY: CONCRETE WASTE MANAGEMENT



Objectives

Housekeeping Practices

Contain Waste

Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion

DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from concrete waste by conducting washout off-site, performing on-site washout in a designated area, and training employees and subcontractors.

APPROACH

The following steps will help reduce storm water pollution from concrete wastes:

- Store dry and wet materials under cover, away from drainage areas.
- Avoid mixing excess amounts of fresh concrete or cement on-site.
- Perform washout of concrete trucks off site or in designated areas only.
- Do not wash out concrete trucks into storm drains, open ditches, streets, or streams.
- Do not allow excess concrete to be dumped on-site, except in designated areas.
- For on-site washout:
 - locate washout area at least 50 feet from storm drains, open ditches, or water bodies. Do not allow runoff from this area by constructing a temporary pit or bermed area large enough for liquid and solid waste;
 - wash out wastes into the temporary pit where the concrete can set, be broken up, and then disposed of properly.
- When washing concrete to remove fine particles and expose the aggregate, avoid creating runoff by draining the water to a bermed or level area.
- Do not wash sweepings from exposed aggregate concrete into the street or storm drain. Collect and return sweepings to aggregate base stock pile, or dispose in the trash.
- Train employees and subcontractors in proper concrete waste management.
- For a quick reference on disposal alternatives for specific wastes, see Table 4.2, CA40, Employee/Subcontractor Training.

REQUIREMENTS

- Costs (Capital, O&M)
 - All of the above are low cost measures.
- Maintenance
 - Inspect subcontractors to ensure that concrete wastes are being properly managed.
 - If using a temporary pit, dispose hardened concrete on a regular basis.

LIMITATIONS

- Off-site washout of concrete wastes may not always be possible.

Targeted Pollutants

- ☐ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☒ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☒ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

CA23

**Best
Management
Practices**

ACTIVITY: CONCRETE WASTE MANAGEMENT (Continue)

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites; Flood Control District of Maricopa County, AZ, July 1992.

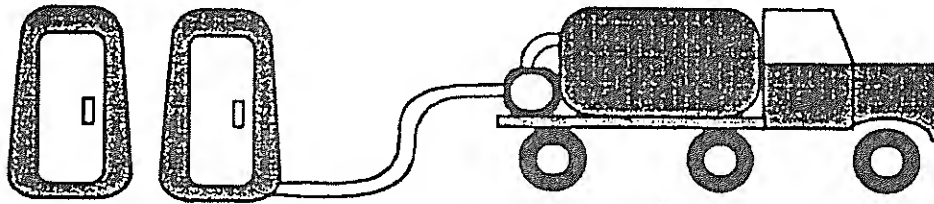
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Storm Water Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

CA23



ACTIVITY: SANITARY/SEPTIC WASTE MANAGEMENT



DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from sanitary/septic waste by providing convenient, well-maintained facilities, and arranging for regular service and disposal.

APPROACH

Sanitary or septic wastes should be treated or disposed of in accordance with State and local requirements. These requirements may include:

- Locate sanitary facilities in a convenient location.
- Untreated raw wastewater should never be discharged or buried.
- Temporary septic systems should treat wastes to appropriate levels before discharging.
- If using an on-site disposal system (OSDS), such as a septic system, comply with local health agency requirements.
- Temporary sanitary facilities that discharge to the sanitary sewer system should be properly connected to avoid illicit discharges.
- If discharging to the sanitary sewer, contact the local wastewater treatment plant for their requirements.
- Sanitary/septic facilities should be maintained in good working order by a licensed service.
- Arrange for regular waste collection by a licensed hauler before facilities overflow.
- For a quick reference on disposal alternatives for specific wastes, see Table 4.2, CA40, Employee/Subcontractor Training.

REQUIREMENTS

- Costs (Capital, O&M)
 - All of the above are low cost measures.
- Maintenance
 - Inspect facilities regularly.
 - Arrange for regular waste collection.

LIMITATIONS

- There are no major limitations to this best management practice.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites; Flood Control District of Maricopa County, AZ, September 1992.

Storm Water Management for Construction Activities, Developing Pollution Prevention Plans and Best Management Practices, EPA 832-R-92005; USEPA, April 1992.

Objectives

Housekeeping Practices

Contain Waste

Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion

Targeted Pollutants

- ☐ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☒ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training
- ☐ Suitability for Slopes >5%

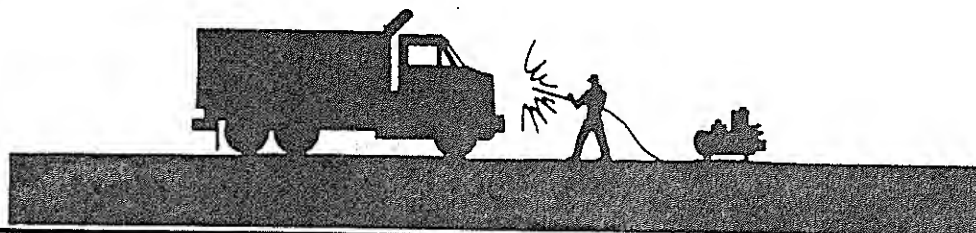
- ☒ High
- ☐ Low

CA24



ACTIVITY: VEHICLE AND EQUIPMENT CLEANING

Graphic: North Central Texas COG, 1993



Objectives

Housekeeping Practices

- Contain Waste
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from vehicle and equipment cleaning by using off-site facilities, washing in designated, contained areas only, eliminating discharges to the storm drain by infiltrating or recycling the wash water, and/or training employees and subcontractors.

APPROACH

- Use off-site commercial washing businesses as much as possible. Washing vehicles and equipment outdoors or in areas where wash water flows onto paved surfaces or into drainage pathways can pollute storm water. If you wash a large number of vehicles or pieces of equipment, consider conducting this work at an off-site commercial business. These businesses are better equipped to handle and dispose of the wash waters properly. Performing this work off-site can also be economical by eliminating the need for a separate washing operation at your site.
- If washing must occur on-site, use designated, bermed wash areas to prevent wash water contact with storm water, creeks, rivers, and other water bodies. The wash area can be sloped for wash water collection and subsequent infiltration into the ground.
- Use as little water as possible to avoid having to install erosion and sediment controls for the wash area.
- Use phosphate-free, biodegradable soaps.
- Educate employees and subcontractors on pollution prevention measures.
- Do not permit steam cleaning on-site. Steam cleaning can generate significant pollutant concentrations.
- For a quick reference on disposal alternatives for specific wastes, see Table 4.2, CA40, Employee/Subcontractor Training.

Targeted Pollutants

- ☐ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

CA30



REQUIREMENTS

- Costs (Capital, O&M)
 - All of the above are low cost measures.
- Maintenance
 - Minimal, some berm repair may be necessary.

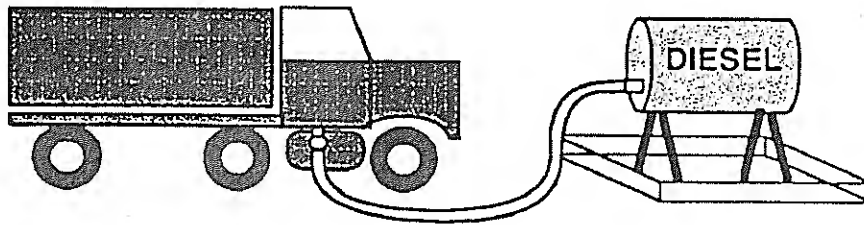
LIMITATIONS

- Even phosphate-free, biodegradable soaps have been shown to be toxic to fish before the soap degrades.
- Sending vehicles/equipment off-site should be done in conjunction with ESC24 (Stabilized Construction Entrance).

REFERENCE

Swisher, R.D., 1987. Surfactant Biodegradation, Marcel Decker Corporation

ACTIVITY: VEHICLE AND EQUIPMENT FUELING



Objectives

Housekeeping Practices

- Contain Waste
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

DESCRIPTION

Prevent fuel spills and leaks, and reduce their impacts to storm water by using off-site facilities, fueling in designated areas only, enclosing or covering stored fuel, implementing spill controls, and training employees and subcontractors.

APPROACH

- Use off-site fueling stations as much as possible. Fueling vehicles and equipment outdoors or in areas where fuel may spill/leak onto paved surfaces or into drainage pathways can pollute storm water. If you fuel a large number of vehicles or pieces of equipment, consider using an off-site fueling station. These businesses are better equipped to handle fuel and spills properly. Performing this work off-site can also be economical by eliminating the need for a separate fueling area at your site.
- If fueling must occur on-site, use designated areas, located away from drainage courses, to prevent the runoff of storm water and the runoff of spills.
- Discourage "topping-off" of fuel tanks.
- Always use secondary containment, such as a drain pan or drop cloth, when fueling to catch spills/leaks.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
- Carry out all Federal and State requirements regarding stationary above ground storage tanks.
- Avoid mobile fueling of mobile construction equipment around the site; rather, transport the equipment to designated fueling areas. With the exception of tracked equipment such as bulldozers and perhaps forklifts, most vehicles should be able to travel to a designated area with little lost time.
- Train employees and subcontractors in proper fueling and cleanup procedures.
- For a quick reference on disposal alternatives for specific wastes, see Table 4.2, CA40, Employee/Subcontractor Training.

REQUIREMENTS

- Costs (Capital, O&M)
 - All of the above measures are low cost, except for the capital costs of above ground tanks that meet all local environmental, zoning, and fire codes.
- Maintenance
 - Keep ample supplies of spill cleanup materials on-site.
 - Inspect fueling areas and storage tanks on a regular schedule.

LIMITATIONS

- Sending vehicles/equipment off-site should be done in conjunction with ESC24 (Stabilized Construction Entrance).

Targeted Pollutants

- ☐ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☒ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

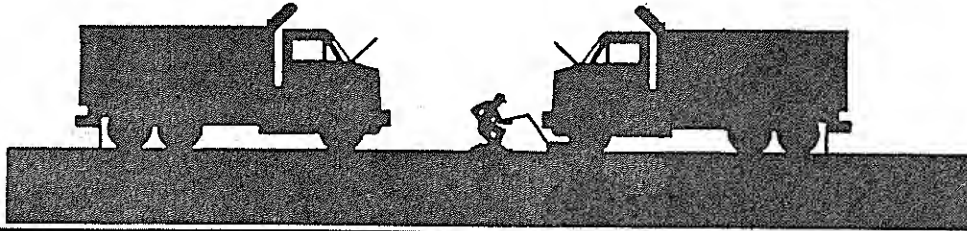
CA31



Best Management Practices

ACTIVITY: VEHICLE AND EQUIPMENT MAINTENANCE

Graphic: North Central Texas COG, 1993



DESCRIPTION

Prevent or reduce the discharge of pollutants to storm water from vehicle and equipment maintenance by running a "dry site". This involves using off-site facilities, performing work in designated areas only, providing cover for materials stored outside, checking for leaks and spills, containing and cleaning up spills immediately, and training employees and subcontractors.

APPROACH

- Keep vehicles and equipment clean, don't allow excessive build-up of oil and grease.
- Use off-site repair shops as much as possible. Maintaining vehicles and equipment outdoors or in areas where vehicle or equipment fluids may spill or leak onto the ground can pollute storm water. If you maintain a large number of vehicles or pieces of equipment, consider using an off-site repair shop. These businesses are better equipped to handle vehicle fluids and spills properly. Performing this work off-site can also be economical by eliminating the need for a separate maintenance area.
- If maintenance must occur on-site, use designated areas, located away from drainage courses, to prevent the runoff of storm water and the runoff of spills.
- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Use adsorbent materials on small spills rather than hosing down or burying the spill. Remove the adsorbent materials promptly and dispose of properly.
- Regularly inspect on-site vehicles and equipment for leaks, and repair immediately.
- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment on-site.
- Segregate and recycle wastes, such as greases, used oil or oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic, and transmission fluids.
- Train employees and subcontractors in proper maintenance and spill cleanup procedures.
- For a quick reference on disposal alternatives for specific wastes, see Table 4.2, CA40, Employee/Subcontractor Training.

REQUIREMENTS

- Costs (Capital, O&M)
 - All of the above are low cost measures.
- Maintenance
 - Keep ample supplies of spill cleanup materials on-site.
 - Inspect maintenance areas on a regular schedule.

Objectives

Housekeeping Practices

- Contain Waste
- Minimize Disturbed Areas
- Stabilize Disturbed Areas
- Protect Slopes/Channels
- Control Site Perimeter
- Control Internal Erosion

Targeted Pollutants

- ☐ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☒ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

CA32



Best Management Practices

ACTIVITY: VEHICLE AND EQUIPMENT MAINTENANCE (Continue)

LIMITATIONS

- Sending vehicles/equipment off-site should be done in conjunction with ESC24 (Stabilized Construction Entrance).

Outdoor vehicle or equipment maintenance is a potentially significant source of storm water pollution. Activities that can contaminate storm water include engine repair and service, particularly changing or replacement of fluids, and outdoor equipment storage and parking (dripping engines). For further information on vehicle or equipment servicing, see CA30, Vehicle and Equipment Cleaning, and CA31, Vehicle and Equipment Fueling.

Listed below is further information if you must perform vehicle or equipment maintenance on-site.

Waste Reduction

Parts are often cleaned using solvents such as trichloroethylene, 1,1,1-trichloroethane, or methylene chloride. Many of these parts cleaners are harmful and must be disposed of as a hazardous waste. Reducing the number of solvents makes recycling easier and reduces hazardous waste management costs. Often, one solvent can perform a job as well as two different solvents. Also, if possible, eliminate or reduce the amount of hazardous materials and waste by substituting non-hazardous or less hazardous materials. For example, replace chlorinated organic solvents (1,1,1-trichloroethane, methylene chloride, etc.) with non-chlorinated solvents. Non-chlorinated solvents like kerosene or mineral spirits are less toxic and less expensive to dispose of properly. Check list of active ingredients to see whether it contains chlorinated solvents. The "chlor" term indicates that the solvent is chlorinated. Also, try substituting a wire brush for solvents to clean parts.

Recycling/Disposal

Separating wastes allows for easier recycling and may reduce disposal costs. Keep hazardous and non-hazardous wastes separate, do not mix used oil and solvents, and keep chlorinated solvents (like 1,1,1-trichloroethane) separate from non-chlorinated solvents (like kerosene and mineral spirits). Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.

Oil filters disposed of in trash cans or dumpsters can leak oil and contaminate storm water. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

Do not dispose of extra paints and coatings by dumping liquid onto the ground or throwing it into dumpsters. Allow coatings to dry or harden before disposal into covered dumpsters.

Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Do not bury used tires.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites; Flood Control District of Maricopa County, AZ, September 1992.

Blueprint for a Clean Bay-Construction-Related Industries: Best Management Practices for Storm Water Pollution Prevention; Santa Clara Valley Nonpoint Source Pollution Control Program, 1992.

Coastal Nonpoint Pollution Control Program: Program Development and Approval Guidance, Working Group Working Paper; USEPA, April 1992.

CA32



ACTIVITY: EMPLOYEE/SUBCONTRACTOR TRAINING

Objectives

Housekeeping Practices

Contain Waste

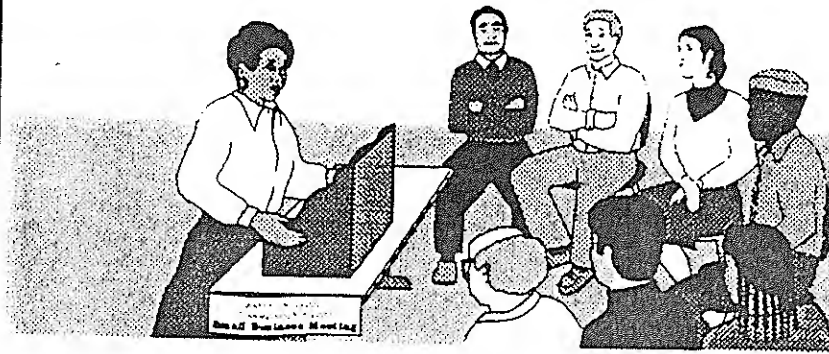
Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion



DESCRIPTION

Employee/subcontractor training, like maintenance or a piece of equipment, is not so much a best management practice as it is a method by which to implement BMPs. This fact sheet highlights the importance of training and of integrating the elements of employee/subcontractor training from the individual source controls into a comprehensive training program as part of a company's Storm Water Pollution Prevention Plan (SWPPP).

The specific employee/subcontractor training aspects of each of the source controls are highlighted in the individual fact sheets. The focus of this fact sheet is more general, and includes the overall objectives and approach for assuring employee/subcontractor training in storm water pollution prevention. Accordingly, the organization of this fact sheet differs somewhat from the other fact sheets in this chapter.

OBJECTIVES

Employee/subcontractor training should be based on four objectives:

- Promote a clear identification and understanding of the problem, including activities with the potential to pollute storm water;
- Identify solutions (BMPs);
- Promote employee/subcontractor ownership of the problems and the solutions; and
- Integrate employee/subcontractor feedback into training and BMP implementation.

APPROACH

- Integrate training regarding storm water quality management with existing training programs that may be required for your business by other regulations such as: the Illness and Injury Prevention Program (IIPP) (SB 198) (California Code of Regulations Title 8, Section 3203), the Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (29 CFR 1910.120), the Spill Prevention Control and Countermeasure (SPCC) Plan (40 CFR 112), and the Hazardous Materials Management Plan (Business Plan) (California Health and Safety Code, Section 6.95).
- Businesses, particularly smaller ones that may not be regulated by Federal, State, or local regulations, may use the information in this Handbook to develop a training program to reduce their potential to pollute storm water.
- Use the quick reference on disposal alternatives (Table 4.2) to train employee/subcontractors in proper and consistent methods for disposal.

CA40



ACTIVITY: EMPLOYEE/SUBCONTRACTOR TRAINING (Continue)

- Consider posting the quick reference table around the job site or in the on-site office trailer to reinforce training.
- Train employee/subcontractors in standard operating procedures and spill cleanup techniques described in the fact sheets. Employee/subcontractors trained in spill containment and cleanup should be present during the loading/unloading and handling of materials.
- Personnel who use pesticides should be trained in their use. The California Department of Pesticide Regulation and county agricultural commissioners license pesticide dealers, certify pesticide applicators, and conduct on-site inspections.
- Proper education of off-site contractors is often overlooked. The conscientious efforts of well trained employee/subcontractors can be lost by unknowing off-site contractors, so make sure they are well informed about what they are expected to do on-site.

CA40



TABLE 4.2 QUICK REFERENCE - DISPOSAL ALTERNATIVES
(Adopted from Santa Clara County Nonpoint Source Pollution Control Program - December 1992)

All of the waste products on this chart are prohibited from discharge to the storm drain system. Use this matrix to decide which alternative disposal strategies to use.
ALTERNATIVES ARE LISTED IN PRIORITY ORDER.

Key: HHW Household hazardous waste (Government-sponsored drop-off events)
 POTW Publically Owned Treatment Plant
 Reg.Bd. Regional Water Quality Control Board (Oakland)
 "Dispose to sanitary sewer" means dispose into sink, toilet, or sanitary sewer clean-out connection.
 "Dispose as trash" means dispose in dumpsters or trash containers for pickup and/or eventual disposal in landfill.
 "Dispose as hazardous waste" for business/commercial means contract with a hazardous waste hauler to remove and dispose.

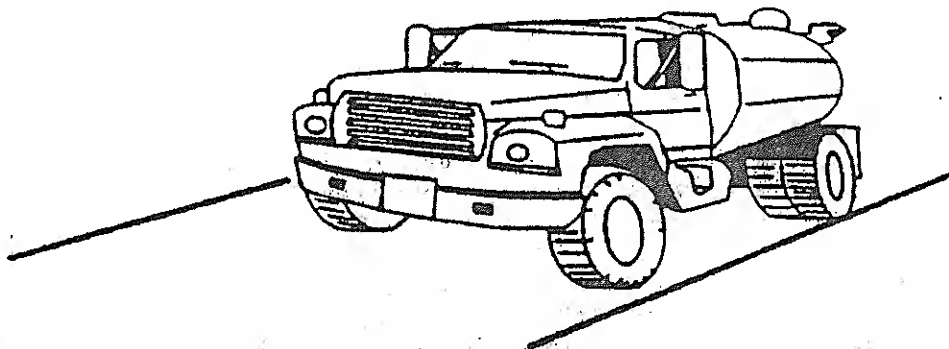
DISCHARGE/ACTIVITY	BUSINESS/COMMERCIAL		RESIDENTIAL
	Disposal Priorities	Approval	Disposal Priorities
General Construction and Painting; Street and Utility Maintenance			
Excess paint (oil-based)	1. Recycle/reuse. 2. Dispose as hazardous waste.		1. Recycle/reuse. 2. Take to HHW drop-off.
Excess paint (water-based)	1. Recycle/reuse. 2. Dry residue in cans, dispose as trash. 3. If volume is too much to dry, dispose as hazardous waste.		1. Recycle/reuse. 2. Dry residue in cans, dispose as trash. 3. If volume is too much to dry, take to HHW drop-off
Paint cleanup (oil-based)	Wipe paint out of brushes, then: 1. Filter & reuse thinners, solvents. 2. Dispose as hazardous waste.		Wipe paint out of brushes, then: 1. Filter & reuse thinners, solvents. 2. Take to HHW drop-off.
Paint cleanup (water-based)	Wipe paint out of brushes, then: 1. Rinse to sanitary sewer.		Wipe paint out of brushes, then: 1. Rinse to sanitary sewer.
Empty paint cans (dry)	1. Remove lids, dispose as trash.		1. Remove lids, dispose as trash.
Paint stripping (with solvent)	1. Dispose as hazardous waste.		1. Take to HHW drop-off.
Building exterior cleaning (high-pressure water)	1. Prevent entry into storm drain and remove offsite 2. Wash onto dirt area, spade in 3. Collect (e.g. mop up) and discharge to sanitary sewer	POTW	
Cleaning of building exteriors which have HAZARDOUS MATERIALS (e.g. mercury, lead) in paints	1. Use dry cleaning methods 2. Contain and dispose washwater as hazardous waste (Suggestion: dry material first to reduce volume)		

TABLE 5.1 EROSION AND SEDIMENT CONTROL AND BMP OBJECTIVES

BMP CATEGORY	BMP OBJECTIVES						
	PRACTICE GOOD HOUSE- KEEPING	CONTAIN WASTE	MINIMIZE DISTURBED AREA	STABILIZE DISTURBED AREA	PROTECT SLOPES AND CHANNELS	CONTROL SITE PERIMETER	CONTROL INTERNAL EROSION
Site Planning Considerations							
ESC1	✓	✓	✓	✓	✓	✓	✓
ESC2			✓	✓	✓	✓	
Vegetative Stabilization							
ESC10				✓	✓		
ESC11				✓	✓		
Physical Stabilization							
ESC20				✓	✓		
ESC21	✓		✓	✓		✓	
ESC22	✓		✓	✓	✓		
ESC23	✓		✓	✓	✓		
ESC24	✓		✓	✓		✓	
Diversion of Runoff							
ESC30		✓			✓	✓	✓
ESC31					✓	✓	✓
ESC32					✓		
Velocity Reduction							
ESC40					✓		
ESC41					✓		
ESC42				✓	✓		

BMP OBJECTIVES									
BMP CATEGORY	PRACTICE GOOD HOUSE- KEEPING	CONTAIN WASTE	MINIMIZE DISTURBED AREA	STABILIZE DISTURBED AREA	PROTECT SLOPES AND CHANNELS	CONTROL SITE PERIMETER	CONTROL INTERNAL EROSION		
	Sediment Trapping/Filtering								
ESC50						✓	✓		
ESC51						✓	✓		
ESC52					✓	✓	✓		
ESC53					✓	✓	✓		
ESC54						✓	✓		
ESC55							✓		
ESC56							✓		

BMP: DUST CONTROLS



Objectives

Housekeeping Practices

Contain Waste

Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion

GENERAL DESCRIPTION

Dust control measures are used to stabilize soil from wind erosion, and reduce dust generated by construction activities.

SUITABLE APPLICATIONS

- Clearing and grading activities.
- Construction vehicle traffic on unpaved roads.
- Drilling and blasting activities.
- Sediment tracking onto paved roads.
- Soil and debris storage piles.
- Batch drop from front end loaders.
- Areas with unstabilized soil.
- Final grading/site stabilization usually is sufficient to control post-construction dust sources.

INSTALLATION/APPLICATION CRITERIA

- Schedule construction activities to minimize exposed area (See ESC 1).
- Quickly stabilize exposed soils using vegetation, mulching, spray-on adhesives, calcium chloride, sprinkling, and stone/gravel layering (See ESC 10 and 11).
- Identify and stabilize key access points prior to commencement of construction (See ESC 24).
- Minimizing the impact of dust by anticipating the direction of prevailing winds.
- Direct most construction traffic to stabilized roadways within the project site (See ESC 23).

REQUIREMENTS

- Maintenance
 - Most dust control measures require frequent, often daily, attention.
- Cost
 - Installation costs for water/chemical dust suppression are low, but annual costs may be quite high since these measures are effective for only a few hours to a few days.

LIMITATIONS

- Watering prevents dust only for a short period and should be applied daily (or more often) to be effective.
- Overwatering may cause erosion.
- Oil should not be used for dust control because the oil may migrate into drainageway and/or seep into the soil.
- Certain chemically-treated subgrades may make soil water repellant, increasing runoff.

Targeted Pollutants

- ☒ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

ESC21



Additional Information — Dust Controls

California's mediterranean climate, with short wet seasons and long hot dry seasons, allow the soils to thoroughly dry out. During these dry seasons, construction activities are at their peak, and disturbance and exposed areas are increasingly subject to wind erosion, sediment tracking and dust generated by construction equipment.

Dust control, as a BMP, is a practice that is already in place for many construction activities. Los Angeles, the North Coast and Sacramento, among others have enacted dust control ordinances for construction activities that cause dust to be transported beyond the construction project property line. Recently, the State Air Resources Control Board has, under the authority of the Clean Air Act, started to address air quality in relation to inhalable particulate matter less than 10 microns (PM-10). 90% of these small particles are considered to be dust. Existing dust control regulations by local agencies, municipal departments, public works department, and/or public health departments are in place in some regions within California. For jurisdictions that have no formal dust control regulations and/or standards, Sections 10, 17 and 18 of CalTrans' Standard Specifications provide detailed provisions for dust control practices.

Many local agencies require dust control in order to comply with local nuisance laws, opacity laws (visibility impairment) and the requirements of the Clean Air Act. The following are measures that local agencies may have already implemented as requirements for dust control from contractors:

- Construction & Grading Permits: Require provisions for dust control plans;
- Opacity Emission Limits: Enforce compliance with California air pollution control laws;
- Increase overall enforcement activities: Priority given to cases involving citizen complaints;
- Maintain Field Application Records: Require records of dust control measures from contractor;
- Stormwater Pollution Prevention Plan: (SWPPP): Integrate dust control measures into SWPPP.

Dust Control Practices

Dust control BMP's generally stabilize exposed surfaces and minimize activities that suspend or track dust particles. Table ESC21.1 shows which Dust Control BMPs apply to site conditions which cause dust. For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel or asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications. Permanent or temporary vegetation and mulching and sand fences can be employed for areas of occasional or no construction traffic. Preventive measures would include minimizing surface areas to be disturbed, limiting on-site vehicle traffic to 15 miles per hour, and controlling the number and activity of vehicles on a site at any given time.

Many of the reasonably available control measures for controlling dust from construction sites can also be implemented as BMPs for storm water pollution prevention. Those BMPs include:

- Pave, vegetate, or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads.
- Provide covers for haul trucks transporting materials that contribute to dust.
- Provide for wet suppression or chemical stabilization of exposed soils.
- Provide for rapid clean-up of sediments deposited on paved roads. Furnish stabilized construction road entrances and vehicle wash down areas.
- Stabilize unpaved haul roads, parking and staging areas. Reduce speed and trips on unpaved roads.
- Implement dust control measures for material stockpiles.
- Prevent drainage of sediment laden storm water onto paved surfaces.
- Stabilize abandoned construction sites using vegetation or chemical stabilization methods.
- Limit the amount of areas disturbed by clearing and earth moving operations by scheduling these activities in phases.

For the chemical stabilization, there are many products available for chemically stabilizing gravel roadways and stockpiles. The types of chemicals available and recommendations for their use are tabulated in Table ESC 21.2, Commonly Used Chemicals for Dust Control.

ESC21



Additional Information — Dust Controls

In addition, there are many other BMPs identified in this handbook that provide dust control including:

- Seeding and Plantings (ESC 10)
- Mulching (ESC 11)
- Construction Road Stabilization (ESC 23)
- Stabilized Construction Entrances (ESC 24)

Limitations

- Oil treated subgrades should not be used because the oil may migrate into drainageways and/or seep into the soil.
- Chemically treated subgrades may make the soil water repellant, interfering with long-term infiltration, and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly.
- Asphalt, as a mulch tack or chemical mulch, requires a 24 hour curing time to avoid adherence to equipment, worker shoes, etc. Application should be limited because asphalt surfacing may eventually migrate into the drainage system.
- In compacted areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

California Air Pollution Control Laws, California Air Resources Board, 1992.

CalTrans, Standard Specifications, Sections 10, "Dust Control"; Section 17, "Watering"; and Section 18, "Dust Palliative".

Prospects for Attaining the State Ambient Air Quality Standards for Suspended Particulate Matter (PM10), Visibility Reducing Particles, Sulfates, Lead, and Hydrogen Sulfide, California Air Resources Board, April 1991.

Sacramento County, Winterization Ordinance & Dust Control Ordinance (example).

USDA Soil Conservation Service, "Guides for Erosion and Sediment Control".

ESC21



TABLE ESC 21.1 DUST CONTROL BMPs FOR GIVEN SITE CONDITIONS

SITE CONDITION	DUST CONTROL BMPs								
	Permanent Vegetation	Mulching	Wet Suppression (Watering)	Chemical Dust Suppression	Gravel or Asphalt Surfacing	Sand Fences	Temporary Gravel Construction Entrances/Equipment Wash Down	Haul Truck Covers	Minimize Extent of Area Disturbed
Disturbed Areas not Subject to Traffic	X	X	X	X	X				X
Disturbed Areas Subject to Traffic			X	X	X				X
Material Stock Pile Stabilization			X	X		X			X
Demolition			X				X	X	
Clearing/Excavation			X	X					X
Truck Traffic on Unpaved Roads			X	X	X			X	
Mud/Dirt Carry-Out					X		X		

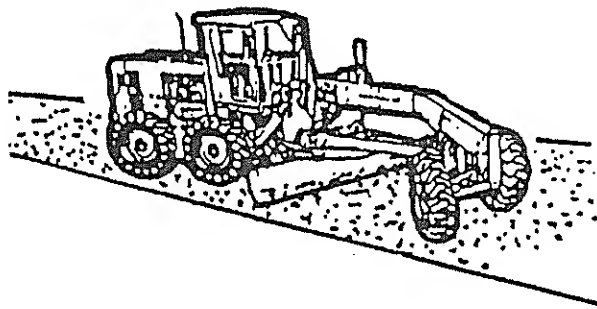
TABLE ESC 21.2 COMMONLY USED CHEMICALS FOR DUST CONTROL

	SALTS	ORGANIC, NON PETROLEUM-BASED	PETROLEUM BASED PRODUCTS ¹
CHEMICAL TYPES	<ul style="list-style-type: none"> Calcium Chloride² Magnesium Chloride Natural Brines 	<ul style="list-style-type: none"> Calcium Lignosulfonate Sodium Lignosulfonate Ammonium Lignosulfonate 	<ul style="list-style-type: none"> Bunker Oil Asphalt Primer Emulsified Asphalt
LIMITATIONS	<p>Can lose effectiveness in dry periods with low humidity. Leaches from road in heavy rain</p> <p>Not recommended for gravel road surfaces with low fines. Recommended 10-20% fines.</p>	<p>Not affected by dry weather and low humidity. Leached from road in heavy rain if not sufficiently cured.</p> <p>Best performance on gravel roads with high surface fines (10-30%) and dense compact surface with loose gravel.</p>	<p>Generally effective regardless of climatic conditions may pothole in wet weather.</p> <p>Best performance on gravel roads with 5-10% fines.</p>
COMMENTS	Calcium Chloride is popular. May become slippery when wet on gravel surfaces with high fines.	Ineffective on gravel surfaces low in fines. May become slippery when wet on gravel surfaces with high fines content.	Creates a hardened crust.

¹ Motor oils and oil treatments are not recommended due to adverse effects on plant life and groundwater.

² Not recommended due to adverse effects on plant life.

BMP: CONSTRUCTION ROAD STABILIZATION



Objectives

Housekeeping Practices

Contain Waste

Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion

GENERAL DESCRIPTION

Access roads, subdivision roads, parking areas, and other on-site vehicle transportation routes should be stabilized immediately after grading and frequently maintained to prevent erosion and control dust.

SUITABLE APPLICATIONS

- Temporary construction traffic.
- Phased construction projects and off-site road access.
- Detour roads.
- Construction during wet weather.

INSTALLATION/APPLICATION CRITERIA

- Road should follow topographic contours to reduce erosion of the roadway.
- The roadway slope should not exceed 15 percent.
- Gravel roads should be a minimum 4-inch thick, 2-3 inch coarse aggregate base applied immediately after grading, or as recommended by soils engineer.
- Chemical stabilizers or water are usually required on gravel or dirt roads to prevent dust (see Dust Control ESC 21).

REQUIREMENTS

- Maintenance
 - Periodically apply additional aggregate on gravel roads.
 - Active dirt construction roads are commonly watered three or more times per day during the dry season.
 - Inspect weekly, and after each rain.
 - Repair any eroded areas immediately.
- Cost
 - Gravel construction roads are moderately expensive, but cost is often balanced by reductions in construction delay.
 - No additional costs for dust control on construction roads should be required above that needed to meet local air quality requirements.

LIMITATIONS

- The roadway must be removed or paved when construction is complete.
- Certain chemical stabilization methods may cause storm water or soil pollution and should not be used (see Dust Control ESC 21).
- Management of construction traffic is subject to air quality control measures. Contact the local air quality management agency.

Targeted Pollutants

- ☒ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training
- ☒ Suitability for Slopes >5%

- ☒ High
- ☐ Low

ESC23



Additional Information — Construction Road Stabilization

Areas which are graded for construction vehicle transport and parking purposes are especially susceptible to erosion and dust. The exposed soil surface is continually disturbed, leaving no opportunity for vegetative stabilization. Such areas also tend to collect and transport runoff waters along their surfaces. During wet weather, they often become muddy quagmires which generate significant quantities of sediment that may pollute nearby streams or be transported off-site on the wheels of construction vehicles. Dirt roads can become so unstable during wet weather that they are virtually unusable.

Efficient construction road stabilization not only reduces on-site erosion but can significantly speed on-site work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather.

Installation/Application Criteria

Where feasible, alternative routes should be made for construction traffic; one for use in dry condition, the other for wet conditions which incorporate the measures listed for this BMP. Permanent roads and parking areas should be paved as soon as possible after grading. As an alternative where construction will be phased, the early application of gravel or chemical stabilization may solve potential erosion and stability problems. Temporary gravel roadway should be considered during the rainy season and/or on slopes greater than 5 percent.

When gravel road is needed, apply a minimum 4-inch course of 2 to 4-inch crushed rock, gravel base, or crushed surfacing base course immediately after grading or the completion of utility installation within the right-of-way. Chemical stabilization may also be used upon compacted native sub-grade (see the Dust Control BMP ESC 21). These chemical controls should be applied per the manufacturer's directions.

Temporary roads should follow the contour of the natural terrain to the maximum extent possible. Slope should not exceed 15 percent. Roadways should be carefully graded to drain transversely. Provide drainage swales on each side of the roadway in the case of a crowned section, or one side in the case of super-elevated section. Simple gravel berms without a trench can also be used.

Installed inlets should be protected to prevent sediment-laden water from entering the storm sewer system (see "Storm Drain Inlet Protection" ESC 54).

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, June 1981.

Stormwater Management Water for the Puget Sound Basin, Washington State Department of Ecology, The Technical Manual - February 1992, Publication # 91-75.

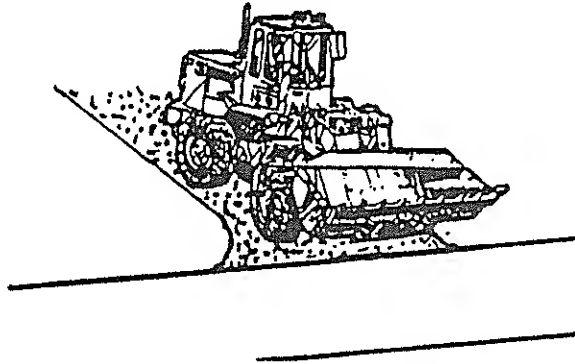
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Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency - November 1988.

ESC23



BMP: STABILIZED CONSTRUCTION ENTRANCE



Objectives

Housekeeping Practices

Contain Waste

Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion

GENERAL DESCRIPTION

The construction entrance practice is a stabilized pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk or parking area. Stabilizing the construction entrance significantly reduces the amount of sediment (dust, mud) tracked off-site, especially if a washrack incorporated for removing caked on sediment.

SUITABLE APPLICATIONS

- All points of construction ingress and egress.
- Unpaved areas where sediment tracking occurs from site onto paved roads.

INSTALLATION/APPLICATION CRITERIA

- Construct on level ground where possible.
- Stones should be 1-3 inches.
- Minimum depth of stones should be 6 inches or as recommended by soils engineer.
- Length should be 50-foot minimum, and 30-foot minimum width.
- Provide ample turning radii as part of entrance.

REQUIREMENTS

- Maintenance
 - Inspect monthly and after each rainfall.
 - Replace gravel material when surface voids are visible.
 - Remove all sediment deposited on paved roadways within 24 hours.
 - Remove gravel and filter fabric at completion of construction
- Cost: Average annual cost for installation and maintenance (Source: EPA, 1992)
 - Without Wash Rock: \$1500 each.
 - With Wash Rock: \$2200 each.

LIMITATIONS

- Requires periodic top dressing with additional stones.
- Should be used in conjunction with street sweeping on adjacent public right-of-way.

Targeted Pollutants

- ☒ Sediment
- ☒ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training
- ☐ Suitability for Slopes >5%

- ☒ High ☐ Low

ESC24



Additional Information — Stabilized Construction Entrance

A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right-of-way, street, alley, sidewalk or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights-of-way or streets. Reducing trackout of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving, a stabilized construction entrance should be used at all points of construction ingress and egress. NPDES permits require that appropriate measures be implemented to prevent trackout of sediments onto paved roadways, which is a significant source of sediments derived from mud and dirt carryout from the unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on the level ground. Advantages of the Stabilized Construction Entrance is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance.

The aggregate for a stabilized construction entrance aprons should be 1 to 3 inches in size, washed, well-graded gravel or crushed rock. Minimum apron dimensions of 30 ft. x 50 ft. and 6 inches deep is adequate for two-way ingress/egress traffic.

The entrance must be properly graded to prevent runoff from leaving the construction site.

When wash areas are provided, washing is done on a reinforced concrete pad (if significant washing is necessary) or in an area stabilized with crushed stone which drains into a properly constructed sediment trap or basin (ESC 55 and 56). Sediment barriers are provided to prevent sediments from entering into the stormwater sewer system, ditch, or waterway.

Limitations

- Construct on level ground.
- Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water runoff.
- Requires periodic top dressing with additional stones.
- Should be used in conjunction with street sweeping on adjacent public right-of-way.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, June 1981.

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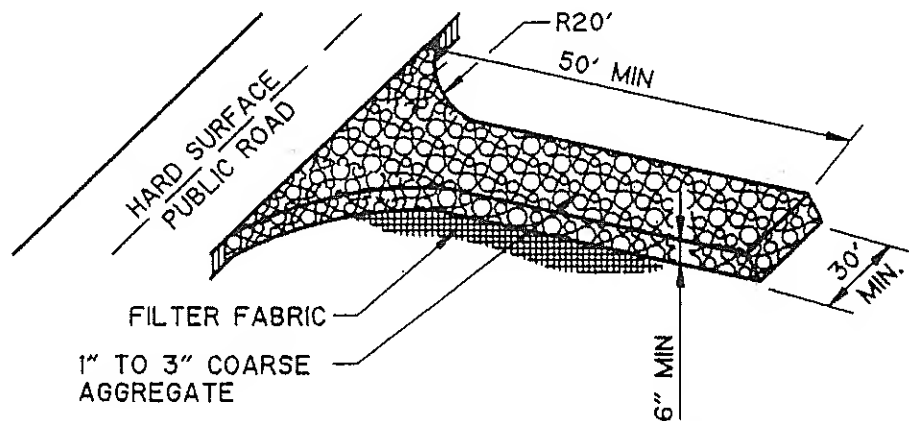
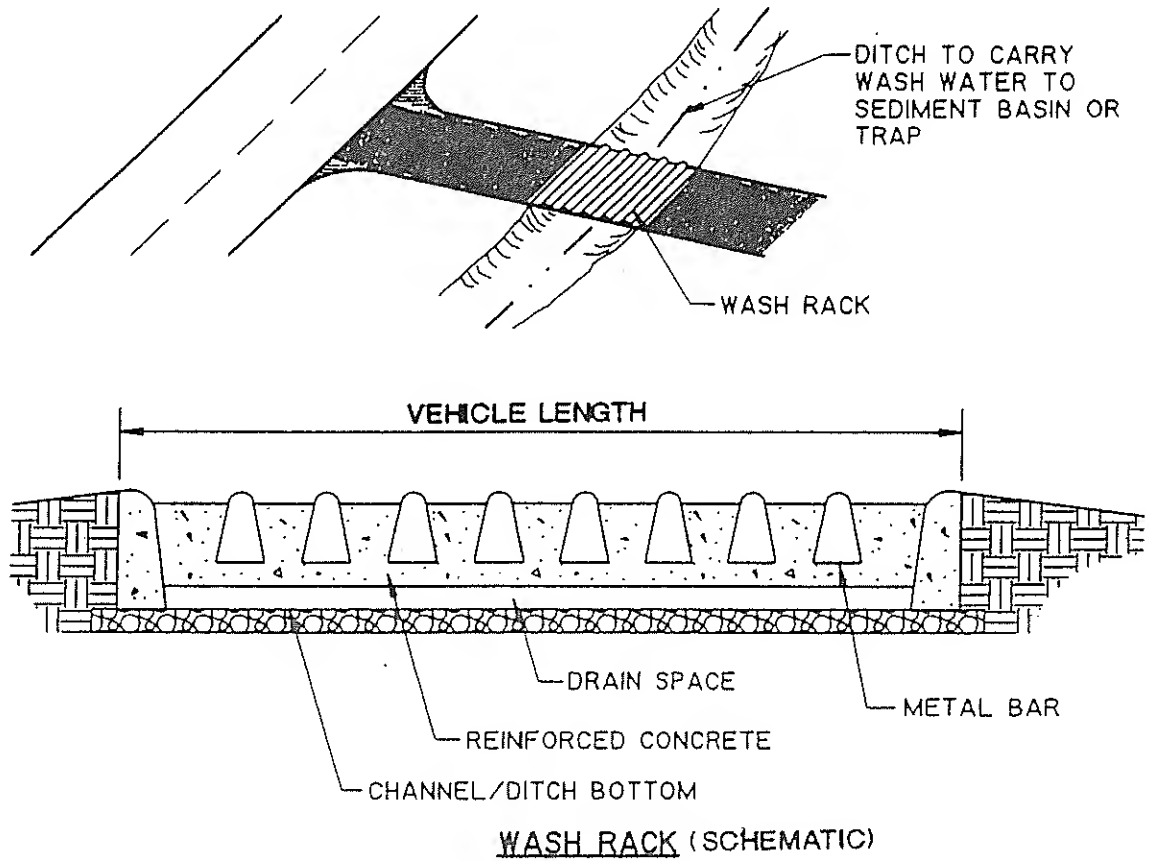
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ESC24



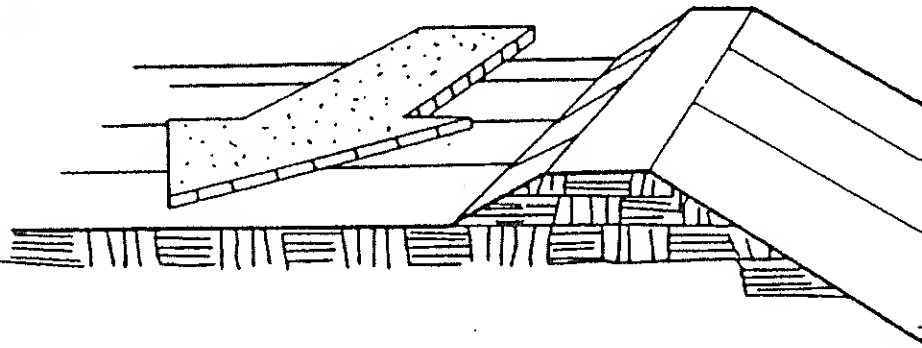
Additional Information — Stabilized Construction Entrance



ESC24



BMP: EARTH DIKE



Objectives

Housekeeping Practices

☒ Contain Waste

☐ Minimize Disturbed Areas

☐ Stabilize Disturbed Areas

☒ Protect Slopes/Channels

☒ Control Site Perimeter

☒ Control Internal Erosion

GENERAL DESCRIPTION

The temporary earth dike is a temporary berm or ridge of compacted soil, used to divert runoff or channel water to a desired location.

SUITABLE APPLICATIONS

Earth dikes are typically used to divert concentrated runoff through disturbed areas into another BMP (e.g., sediment basins), to divert runoff away from disturbed or unstable slopes, to divert runoff from off-site and undisturbed areas around disturbed areas, and as a containment for construction materials and wastes. The dikes should remain in place until the disturbed areas are permanently stabilized. The dikes must be on-site and must safely convey anticipated flood flows.

INSTALLATION/APPLICATION CRITERIA

- All dikes should be compacted by earth-moving equipment.
- All dikes should have positive drainage to a stabilized outlet.
- Top width may be wider and side slopes may be flatter at crossings for construction traffic.
- Dikes should direct sediment-laden runoff into a sediment trapping device.
- Dikes should be stabilized with vegetation, chemicals, or physical devices.

REQUIREMENTS

- Maintenance
 - Inspect periodically and after every significant rainfall; repair as necessary.
- Cost
 - Cost ranges from \$15 to \$55 per foot for both earthwork and stabilization and depends on availability of material, site location, and access.

LIMITATIONS

Dikes should not be used for drainage areas greater than 10 acres, or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built. All drainage structures should be built in compliance with local municipal requirements.

- Earth dikes may create more disturbed area on site and become barriers to construction equipment.
- Earth dikes must be stabilized immediately, which adds cost and maintenance concerns.
- Diverted storm water may cause downstream flood damage.
- Dikes should not be constructed of soils which may be easily eroded.
- Regrading the site to remove the dike may add additional cost.

Targeted Pollutants

- ☒ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☒ Oil & Grease
- ☐ Floatable Materials
- ☒ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☒ Capital Costs
- ☐ O&M Costs
- ☒ Maintenance
- ☐ Training
- ☒ Suitability for Slopes >5%

- ☒ High
- ☐ Low

ESC30



Additional Information — Earth Dike

The temporary earth dike is a berm or ridge of compacted soil, located in such a manner as to divert storm water to a sediment trapping device or stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dikes can also be used to divert runoff from off-site and from undisturbed areas away from disturbed areas, and to divert sheet flows away from unprotected slopes.

An earth dike does not itself control erosion or remove sediment from runoff; a dike prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dikes should not adversely impact adjacent properties and must conform to local floodplain management regulations, and should not be used in areas with slopes steeper than 10%.

- The advantages of the temporary earth dike include the ability to handle flows from large drainage areas.
- Once stabilized, earth dikes require relatively little maintenance. Additionally, the earth dikes are relatively inexpensive to install since the soil material required for construction may be available on-site, and can be constructed as part of the initial grading operations, while the equipment is on-site.
- Uses on-site materials.

Installation/Application Criteria

Temporary earth dikes are a practical, inexpensive BMP used to divert storm water runoff. Temporary diversion dikes should be installed in the following manner:

1. All dikes should be compacted by earth-moving equipment.
2. All dikes should have positive drainage to an outlet.
3. All dikes should have 2:1 side slopes, 18 inches minimum height, and a minimum top width of 24 inches. Top width may be wider and side slopes may be flatter at crossings for construction traffic.
4. The outlet from the earth dike must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a sediment trap (ESC 55) or sediment basin (ESC 56) when either the dike channel or the drainage area above the dike are not adequately stabilized.
5. Temporary stabilization may be achieved using seed and mulching for slopes less than 5%, and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dike should be completed immediately after construction or prior to the first rain.
6. If riprap is used to stabilize the channel formed along the toe of the dike, the following typical specifications apply:

<u>CHANNEL</u>	<u>RIPRAP</u>
<u>GRADE</u>	<u>STABILIZATION</u>
0.5-1.0%	4" Rock
1.1-2.0%	6" Rock
2.1-4.0%	8" Rock
4.1-5.0%	8-12" Riprap
7. The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.
8. Filter cloth may be used to cover dikes in use for long periods.
9. Construction activity on the earth dike should be kept to a minimum.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

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ESC30



Additional Information — Earth Dike

Erosion and Sediment Control Handbook, S.J. Goldman, K. Jackson, T.A. Bursetynsky, P.E., McGraw Hill Book Company.

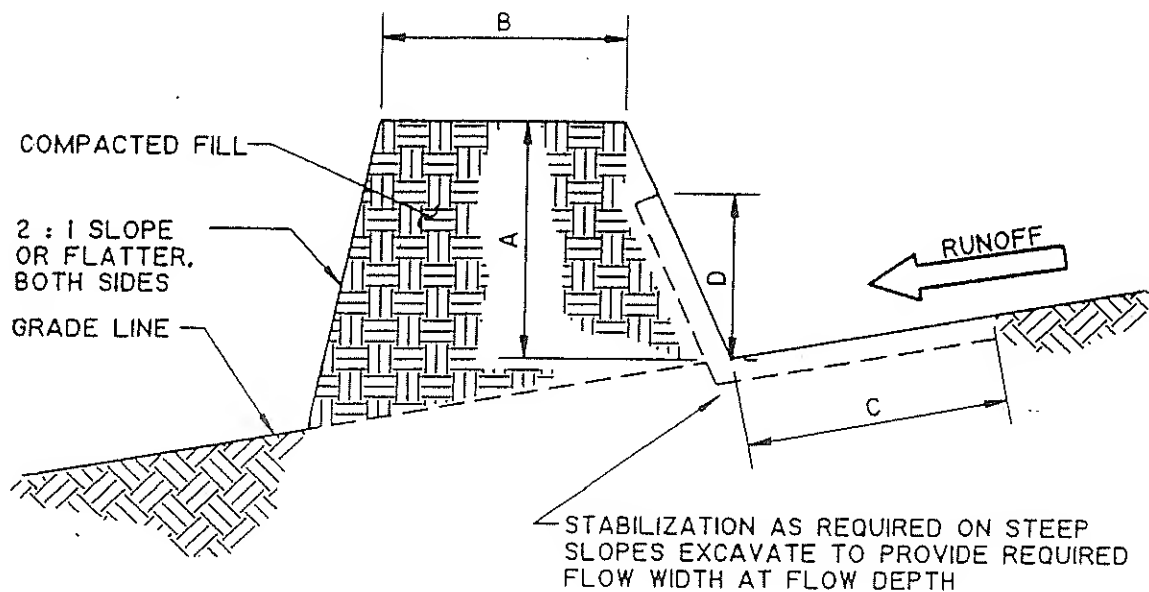
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Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency - November 1988.

ESC30



Additional Information — Earth Dike



REQUIREMENTS BASED ON UPSTREAM DRAINAGE AREA

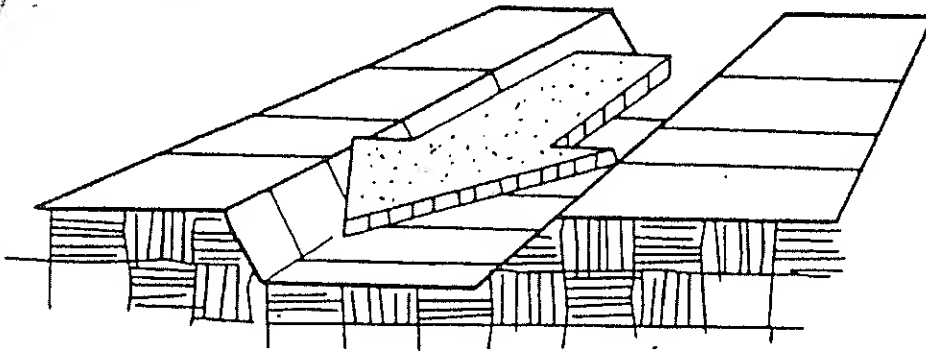
	DIKE 1 (5 ACRES OR LESS)	DIKE 2 (5-10 ACRES)
A-DIKE HEIGHT	18"	36"
B-DIKE WIDTH	24"	36"
C-FLOW WIDTH	4'	6'
D-FLOW DEPTH	8"	15"

TEMPORARY DIVERSION DIKE

ESC30



BMP: TEMPORARY DRAINS AND SWALES



GENERAL DESCRIPTION

Temporary drains and swales are used to divert off-site runoff around the construction site, divert runoff from stabilized areas around disturbed areas, and direct runoff into sediment basins or traps.

SUITABLE APPLICATIONS

Temporary drains and swales are appropriate for diverting any upslope runoff around unstabilized or disturbed areas of the construction site:

- Prevent slope failures.
- Prevent damage to adjacent property.
- Prevents erosion and transport of sediments into water ways.
- Increases the potential for infiltration.
- Diverts sediment-laden runoff into sediment basins or traps.

INSTALLATION/APPLICATION CRITERIA

Temporary drainage swales will effectively convey runoff and avoid erosion if built properly:

- Size temporary drainage swales using local drainage design criteria.
- A permanent drainage channel must be designed by a professional engineer (see the local drainage design criteria for proper design).
- At a minimum, the drain/swale should conform to predevelopment drainage patterns and capacities.
- Construct the drain/swale with an uninterrupted, positive grade to a stabilized outlet.
- Provide erosion protection or energy dissipation measures if the flow out of the drain or swale can reach an erosive velocity.

REQUIREMENTS

- Maintenance
 - Inspect weekly and after each rain.
 - Repair any erosion immediately.
 - Remove sediment which builds up in the swale and restricts its flow capacity.
- Cost
 - The cost of a drainage swale increases with drainage area and slope. Typical swales for controlling internal erosion are inexpensive.

LIMITATIONS

- Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties.
- Temporary drains and swales must conform to local floodplain management requirements.

Objectives

Housekeeping Practices

Contain Waste

Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion

Targeted Pollutants

- ☒ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

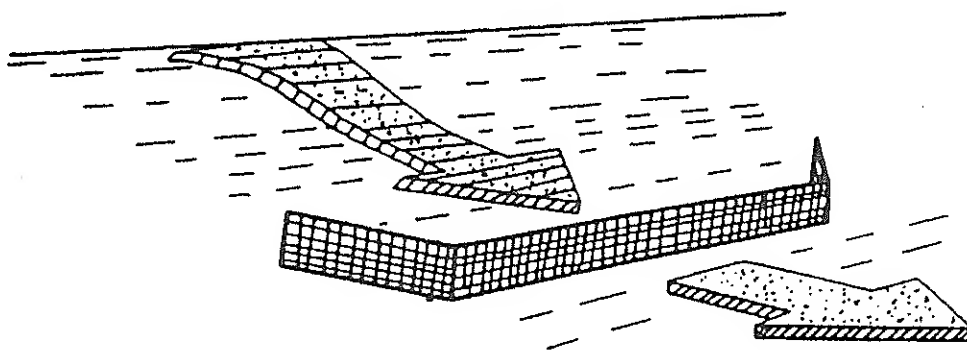
- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training
- ☒ Suitability for Slopes >5%

- ☒ High
- ☐ Low

ESC31



BMP: SILT FENCE



GENERAL DESCRIPTION

A silt fence is made of a filter fabric which has been entrenched, attached to supporting poles, and sometimes backed by a wire fence for support. The silt fence detains sediment-laden water, promoting sedimentation behind the fence.

SUITABLE APPLICATIONS

- Along the perimeter of the site.
- Below the toe of a cleared slope.
- Along streams and channels.
- Around temporary spoil areas.
- Across swales with catchments less than 1 acre.
- Below other small cleared areas.

INSTALLATION/APPLICATION

- Use principally in areas where sheet flow occurs.
- Install along a level contour, so water does not pond more than 1.5 feet at any point.
- No more than 1 acre, 100 ft., or 0.5 cfs of concentrated flow should drain to any point along the silt fence.
- Turn ends of fence uphill.
- Provide area behind the fence for runoff to pond and sediment to settle (approx. 1200 sq. ft. per acre draining to the silt fence).
- Select filter fabric which retains 85% of the soil, by weight, based on sieve analysis, but is not finer than an equivalent opening size of 70.

REQUIREMENTS

- Maintenance
 - Inspect weekly and after each rainfall.
 - Repair wherever fence is damaged.
 - Remove sediment when it reaches 1/3 the height of the fence.
- Cost (source: EPA, 1992)
 - Average annual cost for installation and maintenance (assumes 6 month useful life): \$7 per lineal foot (\$850 per drainage acre)

LIMITATIONS

- Do not use where 85% of the soil, by weight, passes through a No. 200 sieve because the filter fabric will clog.
- Do not place fence on a slope, or across any contour line.
- Do not use in streams, channels, or anywhere flow has concentrated.
- Do not use in locations where ponded water may cause flooding.

Objectives

Housekeeping Practices
 Contain Waste
 Minimize Disturbed Areas
 Stabilize Disturbed Areas
 Protect Slopes/Channels
☒ Control Site Perimeter
☒ Control Internal Erosion

Targeted Pollutants

- ☒ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☒ Capital Costs
- ☒ O&M Costs
- ☒ Maintenance
- ☐ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

ESC50



Additional Information — Silt Fence

A silt fence is a temporary sediment barrier consisting of filter fabric stretched across and attached to supporting posts, entrenched, and, depending upon the strength of the fabric used, supported with wire fence. Silt fences trap sediment in two ways: (1) by intercepting and detaining small amounts of sediment from disturbed areas during construction operations in order to promote sedimentation behind the fence; and (2) by decreasing the velocity of low flows (up to 0.5 cfs) in swales.

Silt fences may be used for perimeter control, placed upstream of the point(s) of discharge of sheet flow from a site. They may also be used as interior controls below disturbed areas where runoff may occur in the form of sheet and rill erosion, and perpendicular to minor swales or ditch lines for up to one acre contributing drainage areas. Silt fences are generally ineffective in locations where the flow is concentrated and are only applicable for sheet or overland flows.

Installation/Application

Planning:

Silt fences are generally most effective when the following placement criteria are followed:

- Limit the upstream drainage area to 1 acre or less when used alone or in combination with sediment basin in a larger site.
- The maximum slope perpendicular to the fence line should be 1:1.
- Limit the maximum sheet or overland flow path length to any point along the fence to 100 feet.
- Limit the concentrated flows reaching the fence to 0.5 cfs.

Silt fences are preferable to straw barriers in many cases. Laboratory work at the Virginia Highway and Transportation Research Council has shown that silt fences can trap a much higher percentage of suspended sediments than can straw bales. While the failure rate of silt fences is lower than that of straw barriers, there are many instances where silt fences have been improperly installed. The following installation methods can improve performance and should be followed:

- Construct the silt fence along a level contour.
- Silt fences should remain in place until the disturbed area is permanently stabilized.
- Provide sufficient room for runoff to pond behind the fence and to allow sediment removal equipment to pass between the silt fence and toes of slopes or other obstructions. About 1200 sq. ft. of ponding area should be provided for every acre draining to the fence.
- Turn the ends of the filter fence uphill to prevent storm water from flowing around the fence.
- Leave an undisturbed or stabilized area immediately downslope from the fence.
- Do not place in live streams or intermittently flowing channels.

Design:

Selection of a filter fabric is based on soil conditions at the construction site (which affect the equivalent opening size (EOS) fabric specification) and characteristics of the support fence (which affect the choice of tensile strength). The designer should specify a filter fabric that retains the soil found on the construction site yet will have openings large enough to permit drainage and prevent clogging. The following criteria is recommended for selection of the equivalent opening size:

1. If 50 percent or less of the soil, by weight, will pass the U.S. standard sieve No. 200, select the EOS to retain 85 percent of the soil. The EOS should not be finer than EOS 70.
2. For all other soil types, the EOS should be no larger than the openings in the U.S. Standard Sieve No. 70 [0.0083 in. (0.21 mm.)] except where direct discharge to a stream, lake, or wetland will occur, then the EOS should be no larger than Standard Sieve No. 100.

ESC50



Additional Information — Silt Fence

To reduce the chance of clogging, it is preferable to specify a fabric with openings as large as allowed by the criteria. No fabric should be specified with an EOS smaller than U.S. Standard Sieve No. 100 [0.0059 in. (0.15 mm.)]. If 85 percent or more of a soil, by weight, passes through the openings in a No. 200 sieve [0.0029 in. (0.074 mm.)], filter fabric should not be used. Most of the particles in such a soil would not be retained if the EOS was too large, and they would clog the fabric quickly if the EOS was small enough to capture the soil.

The fence should be supported by a wire mesh if the fabric selected does not have sufficient strength and bursting strength characteristics for the planned application (as recommended by the fabric manufacturer). Filter fabric material should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six months of expected usable construction life at a temperature range of 0° F. to 120° F.

Installation Guidelines:

Filter fences are to be constructed on a level contour. Sufficient area should exist behind the fence for ponding to occur without flooding or overtopping the fence.

- Posts should be spaced a maximum of 6 feet apart and driven securely into the ground a minimum of 30 inches.
- A trench should be excavated approximately 8 inches wide and 12 inches deep along the line of posts and upslope from the barrier.
- When standard strength filter fabric is used, a wire mesh support fence should be fastened securely to the upslope side of the posts using heavy-duty wire staples at least 1 inch long, tie wires or hog rings. The wire should extend into the trench a minimum of 4 inches.
- The standard strength filter fabric should be stapled or wired to the fence, and 40 inches of the fabric should extend into the trench. When extra-strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated and the filter fabric stapled or wired directly to the posts.
- Avoid the use of joints. The filter fabric should be purchased in a continuous roll, then cut to the length of the barrier. When joints are necessary, filter cloth should be spliced together only at a support post, with a minimum 6 inch overlap, and both ends securely fastened to the post.
- The trench should be backfilled with compacted native material.

Requirements

Maintenance:

Inspect monthly during dry periods and immediately after each rainfall. Repair as necessary. Sediment must be removed when it reaches approximately one third the height of the fence, especially if heavy rains are expected.

Filter fences should not be removed until the upslope area has been permanently stabilized.

Limitations

- Filter fences will create a temporary sedimentation pond on the upstream side of the fence and may cause temporary flooding. Fences not constructed on a level contour will be overtopped by concentrated flow resulting in failure of the filter fence.
- Filter fences are not practical where large flows of water are involved, hence the need to restrict their use to drainage areas of one acre or less, and flow rates of less than 0.5 cfs.
- Problems may arise from incorrect selection of pore size and/or improper installation.
- Do not allow water depth to exceed 1.5 ft. at any point.
- Improperly installed fences are subject to failure from undercutting, overlapping, or collapsing.

ESC50



Additional Information — Silt Fence

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

Environmental Action Manual, City of Austin, Texas, 1989.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, Jun 1981.

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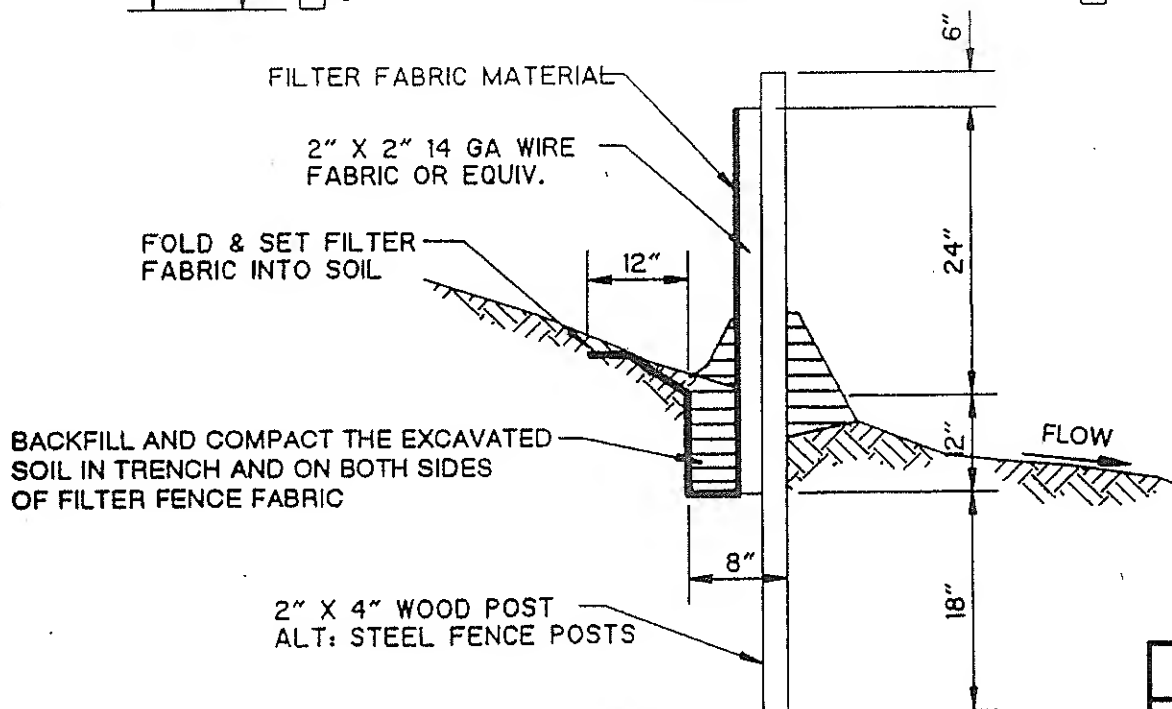
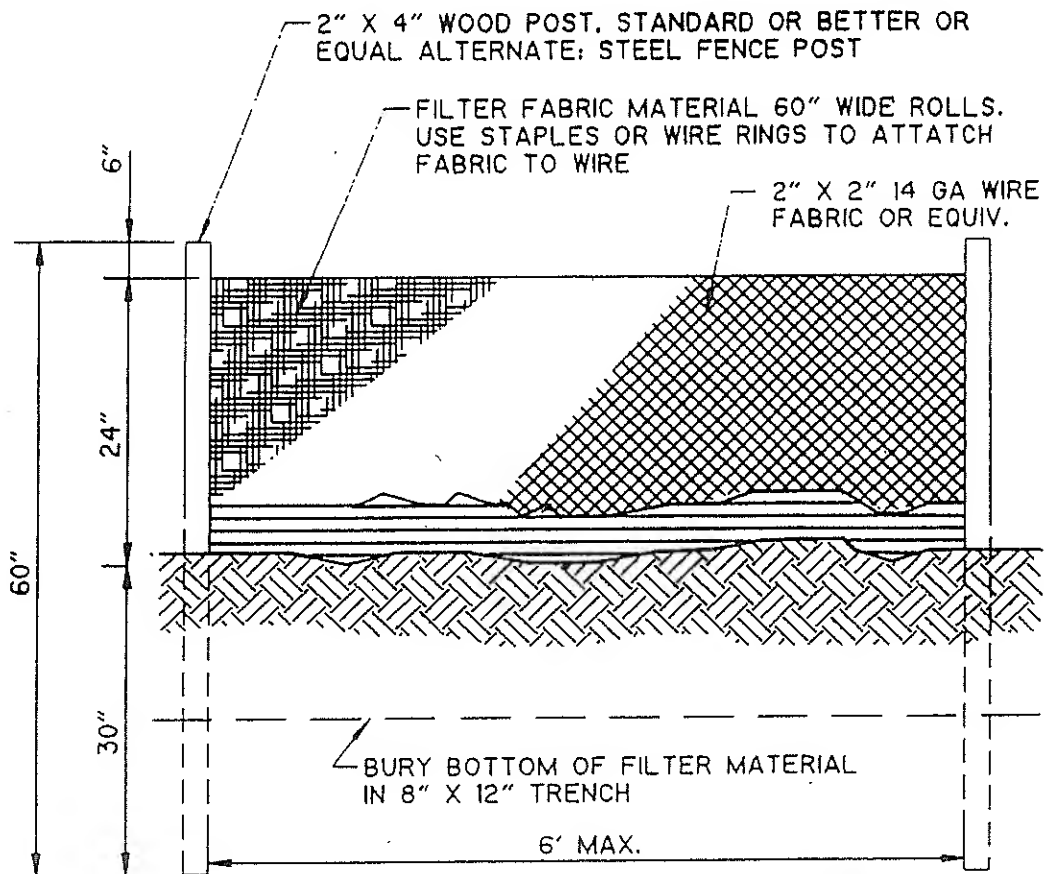
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ESC50



Additional Information — Silt Fence

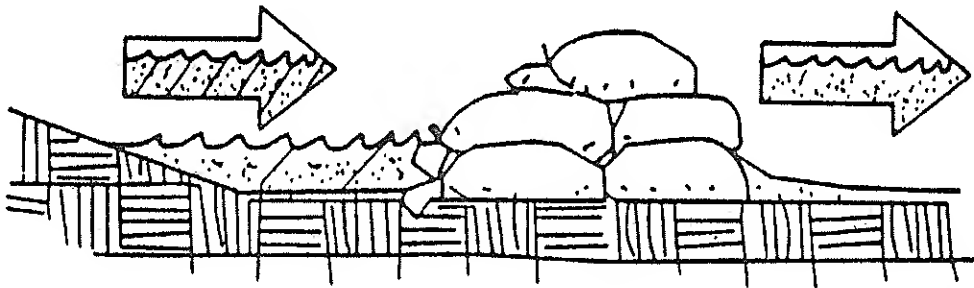


SILT FENCE

ESC50



BMP: SAND BAG BARRIER



Objectives

Housekeeping Practices

Contain Waste

Minimize Disturbed Areas

Stabilize Disturbed Areas

Protect Slopes/Channels

Control Site Perimeter

Control Internal Erosion

GENERAL DEFINITION

Stacking sand bags along a level contour creates a barrier which detains sediment-laden water, ponding water upstream of the barrier and promoting sedimentation.

SUITABLE APPLICATIONS

- Along the perimeter of the site.
- Check dams across streams and channels.
- Along streams and channels.
- Barrier for utility trenches in a channel.
- Across swales with small catchments.
- Division dike or berm.
- Below the toe of a cleared slope.
- Create a temporary sediment trap.
- Around temporary spoil areas.
- Below other small cleared areas.

INSTALLATION/APPLICATION CRITERIA

- May be used in drainage areas up to 5 acres.
- Install along a level contour.
- Base of sand bag barrier should be at least 48 inches wide.
- Height of sand bag barrier should be at least 18 inches high.
- 4 inch PVC pipe may be installed between the top layer of sand bags to drain large flood flows.
- Provide area behind barrier for runoff to pond and sediment to settle, size according to sediment trap BMP criteria (ESC55).
- Place below the toe of a slope.
- Use sand bags large enough and sturdy enough to withstand major flooding.

REQUIREMENTS

- Maintenance
 - Inspect after each rain.
 - Reshape or replace damaged sand bags immediately.
 - Remove sediment when it reaches six inches in depth.
- Cost
 - Sand bag barriers are more costly, but typically have a longer useful life than other barriers.

LIMITATIONS

- Sand bags are more expensive than other barriers, but also more durable.
- Burlap should not be used for sand bags.

Targeted Pollutants

- ☒ Sediment
- ☐ Nutrients
- ☐ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☒ Capital Costs
- ☐ O&M Costs
- ☐ Maintenance
- ☐ Training
- ☒ Suitability for Slopes >5%

- ☒ High
- ☐ Low

ESC52



Best Management Practices

Additional Information — Sand Bag Barrier

Suitable Applications

Sand bag berms may be used during construction activities in stream beds and utility construction in channels, temporary channel crossing for construction equipment, etc. Sand bag berms may also be installed parallel to roadway construction. Sand bag berms may also be used to create temporary sediment traps, retention basins and in place of straw bales or silt fences. Examples of applications include:

- Check dams across stream channels.
- Barriers for utility trenches or other construction in a stream channel.
- At temporary channel crossings.
- May be used on a slope where straw bales and silt fences are not appropriate.
- As a diversion dike.
- Embankment for a temporary sediment basin or retention basin.
- Sediment barriers near the toe of slopes.
- At construction perimeter.

Advantages

- Provides a semi-permeable barrier in potentially wet areas.
- More permanent than silt fences or straw bales.
- Allows for easy relocation on site to meet changing needs during construction.

Installation/Application

Sand bag barriers may be used for sediment trapping in locations where silt fences and straw bale barriers are not strong enough. In addition, sand bag barriers are appropriate to use when construction of check dams or sumps in a stream is undesirable. The sand bag berms can provide the same function as a check dam without disturbing the stream or vegetation. The sand bag berm will also allow a small sediment retention area to be created prior to construction of final detention basins. For installation of a sand bag berm, the following criteria should be observed:

- Drainage Area - Up to five (5) acres.
- Height of Berm - 18 inches minimum height, measured from the top of the existing ground at the upslope toe to the top of the barrier.
- Width of Berm - 48 inches minimum width measured at the bottom of the barrier; 18 inches at the top.
- Sand bag Size - Length 24 to 30 inches, width 16 to 18 inches and thickness six (6) to eight (8) inches. Weight 90 to 125 pounds.
- Sand bag Material - Polypropylene, polyethylene or polyamide woven fabric, minimum unit weight four (4) ounces per square yard, mullen burst strength exceeding 300 psi and ultraviolet stability exceeding 70 percent. Use of burlap is discouraged since it rots and deteriorates easily.
- Grade of Sand - Coarse sand, gravel.
- Runoff water should be allowed to flow over the tops of the sand bags or through four (4) inch polyvinyl chloride pipes embedded below the top layer of bags.
- Area behind the sand bag barrier should be established according to sizing criteria for sediment trap BMP (ESC55).

REFERENCES

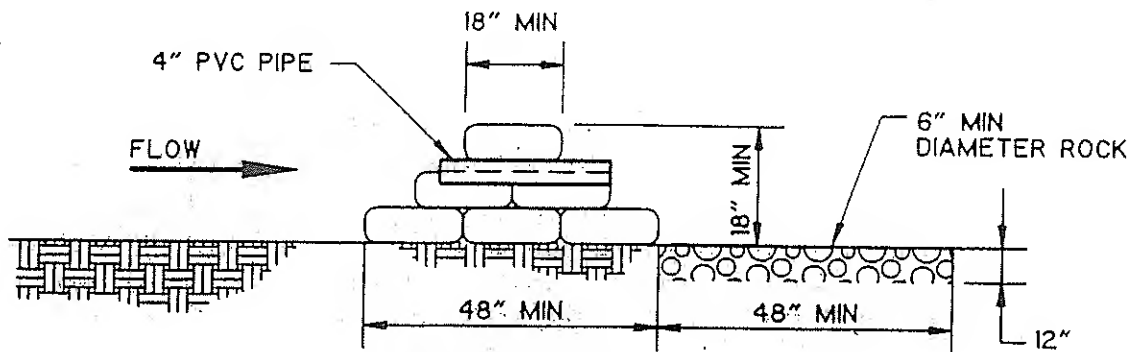
Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Arizona, September 1992.

Water Quality Management Plan for the Lake Tahoe Region, Volume II, Handbook of Management Practices, Tahoe Regional Planning Agency - November 1988.

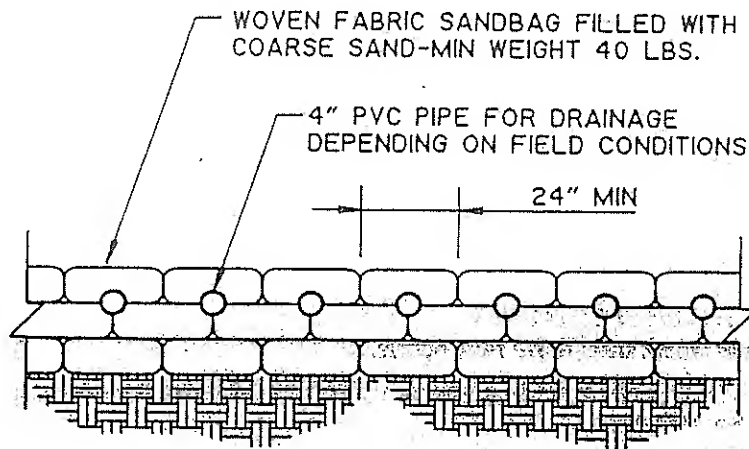
ESC52



Additional Information — Sand Bag Barrier



CROSS-SECTION



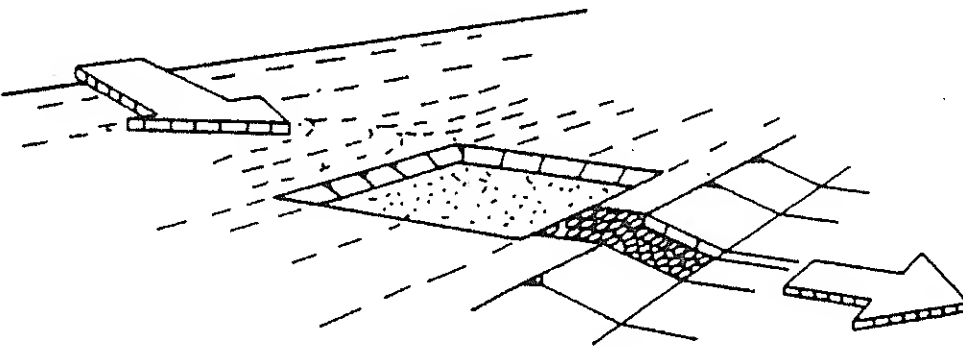
FRONT VIEW

SAND BAG BERM

ESC52



BMP: SEDIMENT TRAP



GENERAL DEFINITION

A sediment trap is a small, excavated or bermed area where runoff from small drainage areas is detained and sediment can settle.

SUITABLE APPLICATIONS

- Any disturbed area less than 5 acres. (Sediment Basins, ESC56, must be used for drainage areas greater than 5 acres).
- Along the perimeter of the site at locations where sediment-laden runoff is discharged off-site.
- Around and/or upslope from storm drain inlet protection measures.
- At any point within the site where sediment-laden runoff can enter stabilized or natural areas or waterways.

INSTALLATION/APPLICATION CRITERIA

- Build outside the area to be graded before clearing, grubbing, and grading begin.
- Locate where the trap can be easily cleared of sediment.
- Trap size depends on the type of soil, size of the drainage area, and desired sediment removal efficiency.
- The larger the trap, the less frequently sediment must be removed.
- The outlet of the trap must be stabilized with rock, vegetation, or another suitable material.
- A stable emergency spillway must be installed to safely convey major floods (see your local flood control agency).

REQUIREMENTS

- Maintenance
 - Remove sediment when the sediment storage zone is no more than 1 ft. from being full.
 - Inspect weekly and after each rain.
- Cost (source: EPA, 1992)
 - Average annual cost per installation and maintenance (18 month useful life) is \$0.70 per ft.³ (\$1,300 per drainage acre).

LIMITATIONS

- Only use for drainage areas up to 5 acres (see Sedimentation Basin BMP ST8 for larger areas).
- Only removes coarse sediment (medium silt size and larger) unless sized like a sedimentation basin.

Objectives

Housekeeping Practices
 Contain Waste
 Minimize Disturbed Areas
 Stabilize Disturbed Areas
 Protect Slopes/Channels
 Control Site Perimeter
 Control Internal Erosion

Targeted Pollutants

- ☒ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☒ O&M Costs
- ☐ Maintenance
- ☐ Training
- ☐ Suitability for Slopes >5%

- ☒ High
- ☐ Low

ESC 55



Additional Information — Sediment Trap

A sediment trap is a small temporary ponding area, usually with a gravel outlet, formed by excavation and/or by constructing an earthen embankment. Its purpose is to collect and store sediment from sites cleared and/or graded during construction. It is intended for use on small drainage areas, with no unusual drainage features, and projected for a quick build-out time. It should help in removing coarse sediment from runoff. The trap is a temporary measure with a design life of approximately 6 months, and is to be maintained until the site area is permanently protected against erosion by vegetation and/or structures.

Application Criteria

Planning:

Sediment traps should be used only for small drainage areas. If the contributing drainage area is greater than 5 acres, refer to Sediment Basins (ST8), or subdivide the catchment area into smaller drainage basins.

Sediment usually must be removed from the trap after each rainfall event. The SWPPP should detail how this sediment is to be disposed of, such as for in fill areas on-site, or removal to an approved off-site dump. Sediment traps used as a perimeter control should be installed before any land disturbance takes place in the drainage area.

Sediment traps are usually small enough that a failure of the structure would not result in a loss of life, damage to home or buildings, or interruption in the use of public roads or utilities. Also, sediment traps are attractive to children and can be dangerous. The following recommendations should be implemented to reduce risks.

1. Install continuous fencing around the sediment trap or pond. Consult local ordinances regarding requirements for maintaining health and safety.
2. Restrict basin side slopes to 3:1 or flatter.

Design:

Sediment trap size depends on the type of soil, size of the drainage area, and desired sediment removal efficiency (see Sedimentation Basin ESC56). As a rule of thumb, the larger the basin volume the greater the sediment removal efficiency. Sizing criteria are typically established under the local grading ordinance or equivalent. The runoff volume from a two-year, 24-hour storm is a common design criteria for sedimentation trap. The sizing criteria below assume that this runoff volume is 0.042 ac-ft/ac (0.5 inches of runoff). While the climatic, topographic, and soil type extremes make it difficult to establish a statewide standard, the following criteria should trap moderate to high amounts of sediment in most areas of California.

- Trap settling volume at least 67 cu. yd. per acre.
- Trap sediment storage volume at least 33 cu. yd. per acre (note: the larger this volume, the less frequently the trap must be cleaned out).
- Trap length greater than twice the basin width.
- Flood volume large enough to contain a major flood without upstream damage and overtopping the embankment.

Installation

Sediment traps can be constructed by excavating a depression in the ground or creating an impoundment with a barrier or low-head dam. Sediment traps should be installed outside the area being graded and should be built prior to the start of the grading activities or removal of vegetation. To minimize the area disturbed by them, sediment traps should be installed in natural depressions or in small swales or drainageways. The following steps must be followed during installation.

1. The area under the embankment must be cleared, grubbed, and stripped of any vegetation and root mat. The pool area should be cleared.
2. The fill material for the embankment must be free of roots or other woody vegetation as well as oversized stones, rocks, organic material, or other objectionable material. The embankment may be compacted by traversing with equipment while it is being constructed.

ESC55



Additional Information — Sediment Trap

3. The trap is removed and the area stabilized when the upslope drainage area has been properly stabilized.
4. All cut-and-fill slopes should be 3:1 or flatter.
5. When a riser is used, all pipe joints must be watertight.
6. When a riser is used, at least the top two-thirds of the riser shall be perforated with 1/2-inch diameter holes spaced 8 inches vertically and 10 to 12 inches horizontally. (See Sediment Basin, ESC56)
7. When an earth or stone outlet is used, the outlet crest elevation should be at least 1 foot below the top of the embankment.
8. When a crushed stone outlet is used, the crushed stone used in the outlet should meet AASHTO M43, size No. 2 or 24, or its equivalent such as MSHA No. 2. Gravel meeting the above gradation may be used if crushed stone is not available.

REFERENCES

Best Management Practices and Erosion Control Manual for Construction Sites, Flood Control District of Maricopa County, Rough Draft - July 1992.

"Draft - Sedimentation and Erosion Control, An Inventory of Current Practices", U.S.E.P.A., April, 1990.

"Environmental Criteria Manual", City of Austin, Texas.

Manual of Standards of Erosion and Sediment Control Measures, Association of Bay Area Governments, June 1981.

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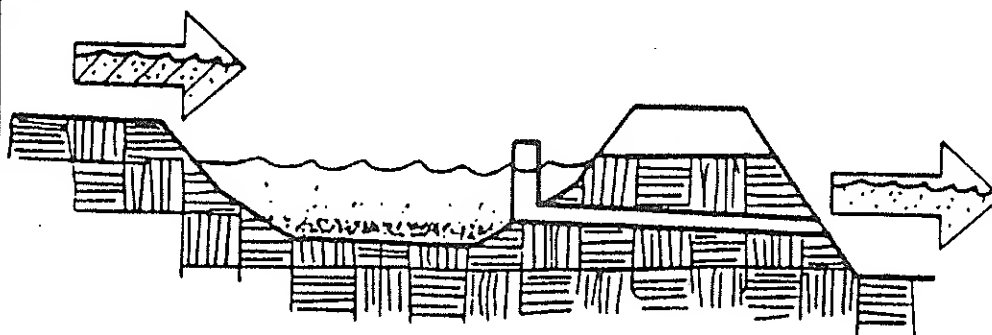
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ESC55



BMP: SEDIMENT BASIN



Objectives

Housekeeping Practices
Contain Waste
Minimize Disturbed Areas
Stabilize Disturbed Areas
Protect Slopes/Channels
Control Site Perimeter
Control Internal Erosion

GENERAL DEFINITION

A pond created by excavation or constructing an embankment, and designed to retain or detain runoff sufficiently to allow excessive sediment to settle.

SUITABLE APPLICATIONS

- At the outlet of all disturbed watershed 10 acres or larger.
- At the outlet of smaller disturbed watersheds, as necessary.
- Where post construction detention basins will be located.
- Should be used in association with dikes, temporary channels, and pipes used to divert disturbed areas into the basin and undisturbed areas around the basin.

INSTALLATION/APPLICATION

- Construct before clearing and grading work begins.
- Do not locate in a stream.
- All basin sites should be located where failure of the embankment would not cause loss of life/property damage.
- Large basins are subject to state/local dam safety requirements.
- Securely anchor and install an anti-seep collar on the outlet pipe/riser, and provide an emergency spillway for passing major floods (see local flood control agency).
- The basin volume should be sized to capture runoff from a 2-year, 24-hour storm, or other appropriate design storms specified by the local agency. A detention time of 24 to 40 hours should allow 70 to 80 percent of sediment to settle.
- The basin volume consists of two zones:
 - A sediment storage zone at least 1 foot deep.
 - A settling zone at least 2 feet deep.
- The length to settling depth ratio (L/SD) should be less than 200.
- The length to width ratio should be greater than 6:1, or baffles are required to prevent short circuiting.

REQUIREMENTS

- Maintenance
 - Inspect weekly and after each rain.
 - Remove sediment where the sediment storage zone is half full.
- Cost: Average annual cost for installation and maintenance (2 year useful life, source: EPA, 1992)
 - Basin less than 50,000 ft.³: \$0.40 per ft.³ (\$700 per drainage acre)
 - Basin size greater than 50,000 ft.³: \$0.20 per ft.³ (\$350 per drainage acre)

Targeted Pollutants

- ☒ Sediment
- ☐ Nutrients
- ☒ Toxic Materials
- ☐ Oil & Grease
- ☐ Floatable Materials
- ☐ Other Construction Waste

- ☒ Likely to Have Significant Impact
- ☐ Probable Low or Unknown Impact

Implementation Requirements

- ☐ Capital Costs
- ☒ O&M Costs
- ☐ Maintenance
- ☐ Training
- ☐ Suitability for Slopes >5%

- ☒ High ☐ Low

ESC56



BMP: SEDIMENT BASIN (Continue)

LIMITATIONS

- The basin should have shallow side slopes (minimum 4:1) or be fenced to prevent drowning.
- Sites with very fine sediments (fine silt and clay) may require longer detention times for effective sediment removal.
- Basins in excess of 25 feet height and/or an impounding capacity of 50 ac. ft. must obtain approval from Division of Safety of Dams.
- Standing water may cause mosquitos or other pests to breed.
- Basins in excess of certain depth and storage volume criteria must meet State Division of Safety of Dams (DSOD) and local safety requirements.

ESC56



Additional Information — Sediment Basin

A sediment basin is a controlled storm water release structure formed by excavation or by constructing an embankment of compacted soil across a drainageway, or other suitable location. Its purpose is to collect and store sediment from sites cleared and/or graded during construction or for extended periods of time before reestablishment of permanent vegetation and/or construction of permanent drainage structures. It is intended to trap sediment before it leaves the construction site. The basin is a temporary measure (with a design life of 12 to 18 months) and is to be maintained until the site area is permanently protected against erosion or a permanent detention basin is constructed.

Sedimentation basins are suitable for nearly all types of construction projects. Whenever possible, construct the sedimentation basins before clearing and grading work begins.

Basins should be located at the stormwater outlet from the site, but not in any natural or undisturbed stream. A typical application would include temporary dikes, pipes, and/or channels to divert runoff to the basin inlet.

Many development projects in California will be required by local ordinances to provide a storm water detention basin for post-construction flood control, desiltation, or storm water pollution control. A temporary sediment basin may be constructed by rough grading the post-construction control basins early in the project.

Sediment basins trap 70-80 percent of the sediment which flows into them if designed according to this handbook. Therefore, they should be used in conjunction with erosion control practices such as temporary seeding, mulching, diversion dikes, etc., to reduce the amount of sediment flowing into the basin.

Installation/Application Criteria

Planning:

To improve the effectiveness of the basin, it should be located to intercept runoff from the largest possible amount of disturbed area. The best locations are generally low areas below disturbed areas. Drainage into the basin can be improved by the use of diversion dikes and ditches. The basin must not be located in a stream but should be located to trap sediment-laden runoff before it enters the stream. The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

Design:

- The sedimentation basin volume consists of two zones:
 - The sediment storage zone (at least 1 foot in depth).
 - A settling zone at least 2 feet in depth.
- The sedimentation basin may be formed by partial excavation and/or by construction of a compacted embankment. It may have one or more inflow points.
- A securely anchored riser pipe with an anti-seep collar is the principal outlet, along with an emergency overflow spillway. A solid riser pipe with two 1-inch diameter dewatering holes located at the top of the sediment storage volume on opposite sides of the riser pipe usually provides sufficient detention time for basins draining about 10 acres. Rock, rip-rap, or other suitable outlet protection is provided to reduce erosion at the riser pipe outlet.
- Settling Zone Volume

ESC56



Additional Information — Sediment Basin

The settling zone volume is determined by the following equation:

$$(V) = 1.2(SD)Q / V_{SED}$$

Q = design inflow based on the peak discharge from a specified design storm (e.g., a 2-year, 24-hour duration design storm event) from the tributary drainage area as computed using the methods required by the local flood control agency. Provide a minimum of 67 cubic yards of settling volume per acre of drainage if a design storm is not specified.

V_{SED} = the settling velocity of the design soil particle. The design particle chosen is medium silt (0.02 mm). This has a settling velocity (V_{SED}) of 0.00096 ft/sec. As a general rule it will not be necessary to design for a particle of size less than 0.02 mm, especially since the surface area requirement increases dramatically for smaller particle sizes. For example, a design particle of 0.01 mm requires about three times the surface area of 0.02 mm. Note also that choosing V_{SED} of 0.00096 ft/sec equates to a surface area (SA) of 1250 sq. ft. per cfs of inflow.

SD = settling depth, which should be at least 2 ft., and no shallower than the average distance from the inlet to the outlet of the pond (L) divided by 200 (i.e., $SD > L/200$).

Total sediment basin volume and dimension are determined as outlined below:

- The details shown in the attached figure may be useful in designing the sediment basin.
- Determine basin geometry for the sediment storage volume calculated above using a minimum of 1 ft depth and 3:1 side slopes from the bottom of the basin. Note, the basin bottom is level.
- Extend the basin side slopes (at 3:1 max.) as necessary to obtain the settling zone volume as determined above.
- Adjust the geometry of the basin to effectively combine the settling zone volume and sediment storage volumes while preserving the depth and side slope criteria.
- Provide an emergency spillway with a crest elevation one foot above the top of the riser pipe.
- The ratio between the basin length and width of the pond should either be greater than 6:1, or baffles should be installed to prevent short-circuiting.

Limitations

Sediment traps and ponds must be installed only within the property limits. Failure of the structure must not result in loss of life, damage to homes or buildings, or interruption of use or service of public roads or utilities. Also, sediment traps and ponds are attractive to children and can be very dangerous. Local ordinances regarding health and safety must be adhered to. If fencing of the pond is required, the type of fence and its location shall be shown in the SWPPP and in the construction specifications.

- Generally, temporary sedimentation ponds are limited to drainage of 5 acres or more.
- Sediment ponds may be capable of trapping smaller sediment particles if additional detention time is provided. However, they are most effective when used in conjunction with other BMPs such as seeding or mulching.
- Ponds may become an "attractive nuisance" and care must be taken to adhere to all safety practices.
- Sediment ponds designed according to this handbook are only practically effective in removing sediment down to about the medium silt size fraction. Sediment-laden runoff with smaller size fractions (fine silt and clay) will pass through untreated emphasizing the need to stabilize the soil quickly.

ESC56



Additional Information — Sediment Basin

REFERENCES

A Current Assessment of Urban Best Management Practices: Techniques for Reducing Nonpoint Source Pollution in the Coastal Zones, Metropolitan Washington Council of Governments, March, 1992.

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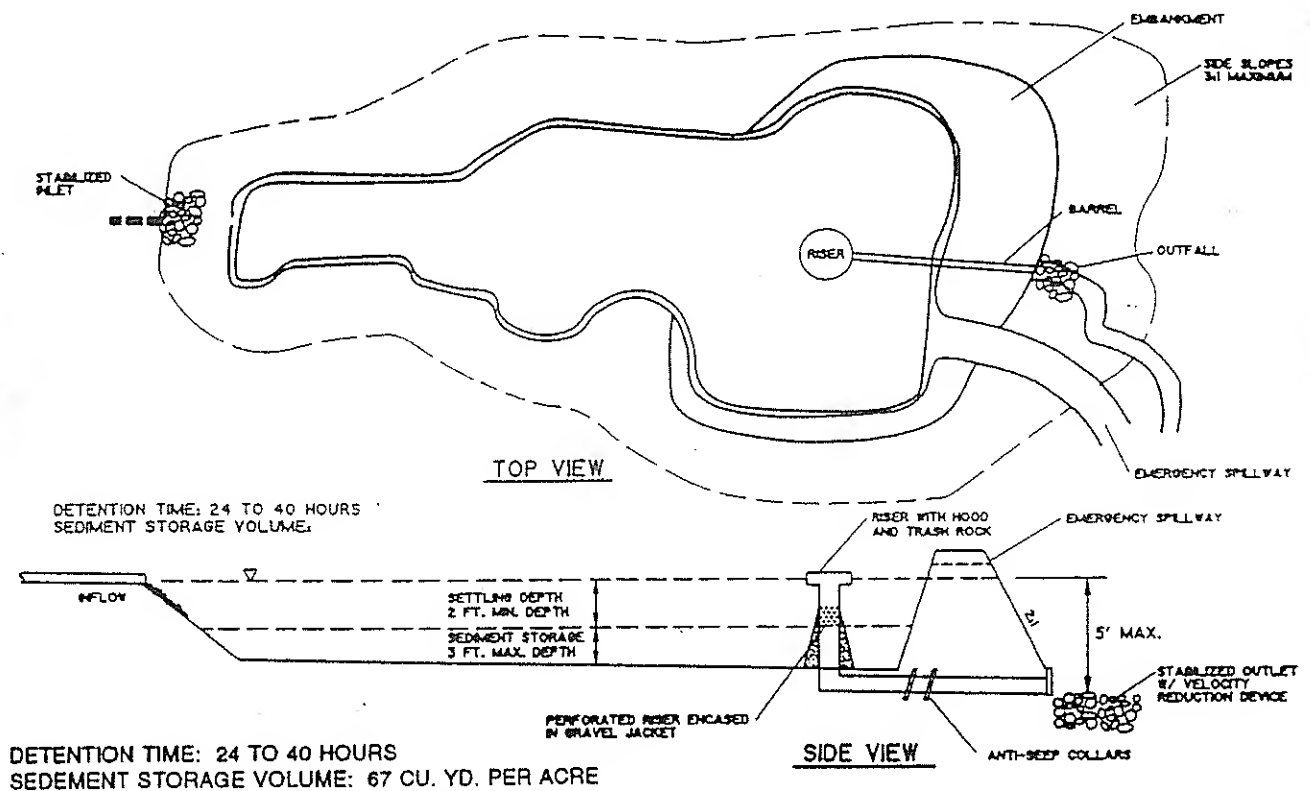
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ESC56



Additional Information — Sediment Basin



TEMPORARY SEDIMENT BASIN

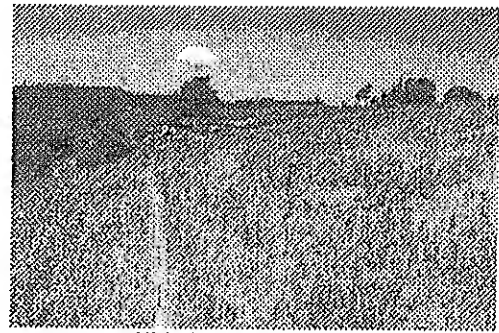
ESC56



• STRAW ROLLS



Click picture to expand view.



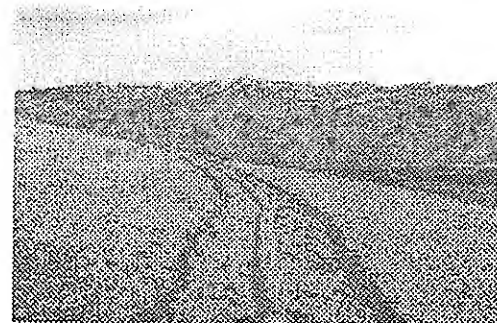
Click picture to expand view.

Definition: Straw rolls are manufactured from straw that is wrapped in tubular black plastic netting. They are approximately 8 inches (200 mm) in diameter by 25-30 feet (8-9 m) long. Rolls are placed and staked along the contour of newly constructed or disturbed slopes.

Purpose: Straw rolls are intended to capture and keep sediment on the slopes. Straw rolls are useful to temporarily stabilize slopes by reducing soil creep and sheet and rill erosion until permanent vegetation can get established. Installed, straw rolls shorten the slope length, thereby interrupting the raveling and rilling processes, and reduce the slope steepness. They catch soil material that moves down the slope by the freeze/thaw processes. Organic matter and native seeds are trapped behind the rolls, which provide a stable medium for germination. Rolls trap fertile topsoil and retain moisture from rainfall, which aids in growth of tree seedlings planted along the upslope side of the rolls.

Design Considerations: Sites appropriate for straw rolls are:

- slopes susceptible to sheet and rill erosion;
- slopes producing dry ravel;
- slopes susceptible to freeze/thaw activity; or slopes difficult to vegetate because of soil movement. Straw rolls are not intended for use in concentrated flow situations.



Erosion control practices such as straw rolls and hydraulic planting and mulching protected this slope during an El Niño winter.

It is imperative, especially on steeper slopes, that a sufficient trench is constructed to place the roll in. Without it, the roll will not function properly, runoff will scour underneath it, and trees or shrubs planted behind the roll will not have a stable environment in which to become established.

Straw rolls will last an average of one to two years. This is an important factor when planning the optimum length of time the slope will need mechanical stabilization.

Straw rolls can be staked with willow stakes if site conditions warrant and the moisture retained by the straw roll will encourage willow establishment.

Advantages:

- Straw rolls are a relatively low-cost solution to sheet and rill erosion problems.
- They can replace silt fences or straw bales on steep slopes.
- Rolls are a short-term solution to help establish native vegetation.
- Rolls store moisture for vegetation planted immediately upslope.
- Plastic netting will eventually photodegrade, eliminating the need for retrieval of materials after the straw has broken down.
- Straw becomes incorporated into the soil with time, adding organic material to the soil and retaining moisture for vegetation.

Disadvantages:

- Rolls only function for one or two seasons.
- Pilot holes through the rolls must be predriven with a metal rod.
- If not installed properly with a sufficient trench, rolls may fail during the first rain event.
- Straw rolls may require maintenance to ensure that the stakes are holding and the rolls are still in contact with the soil. This is especially true on steep slopes in sandy soil.

Construction Specifications:

- Prepare the slope before the wattling procedure is started.
- Shallow gullies should be smoothed as work progresses.
- Dig small trenches across the slope on contour, to place rolls in. The trench should be deep enough to accommodate half the thickness of the roll. When the soil is loose and uncompacted, the trench should be deep enough to bury the roll 2/3 of its thickness because the ground will settle.
- It is critical that rolls are installed perpendicular to water movement, parallel to the slope contour.
- Start building trenches and install rolls from the bottom of the slope and work up.
- Construct trenches at contour intervals of 3-12 feet (1-4 m) apart depending on steepness of slope. The steeper the slope, the closer together the trenches.
- Lay the roll along the trenches fitting it snugly against the soil. Make sure no gaps exist between the soil and the straw wattle.
- Use a straight bar to drive holes through the wattle and into the soil for the willow or wooden stakes.
- Drive the stake through prepared hole into soil. Leave only 1 or 2 inches (25 or 51 mm) of stake exposed above roll.
- If using willow stakes refer to Live Staking BMP.
- Install stakes at least every 4 feet (1.2 m) apart through the wattle. Additional stakes may be driven on the downslope side of the trenches on highly erosive or very steep slopes.

Inspection and Maintenance:

- Inspect the straw rolls and the slopes after significant storms. Make sure the rolls are in contact with the soil.
- Repair any rills or gullies promptly.
- Reseed or replant vegetation if necessary until the slope is stabilized.

Source: John McCullah - CPESC; California Straw Works.

THE FOLLOWING IS A SPECIFICATION**FOR *STRAW WATTLES*[™]:**

Straw Wattles shall be manufactured from rice straw and be wrapped in a tubular plastic netting. The netting shall have a strand thickness of 0.03 inch, and a knot thickness of 0.055 and a weight of 0.35 ounce per foot (each +/- 10%) and shall be made from 85% high density polyethylene, 14% ethyl vinyl acetate and 1% color for UV inhibition. Straw Wattles shall be nine inches in diameter (+/- one inch), twenty-five feet long (+/- 0.5 feet) and weigh approximately 35 pounds (+/- 10%).

Straw Wattles shall be installed as shown on the plans. They shall be placed on contour and staked with 18 or 24 inch wood stakes at four foot on center. The ends of adjacent Straw Wattles shall be abutted to each other snugly.

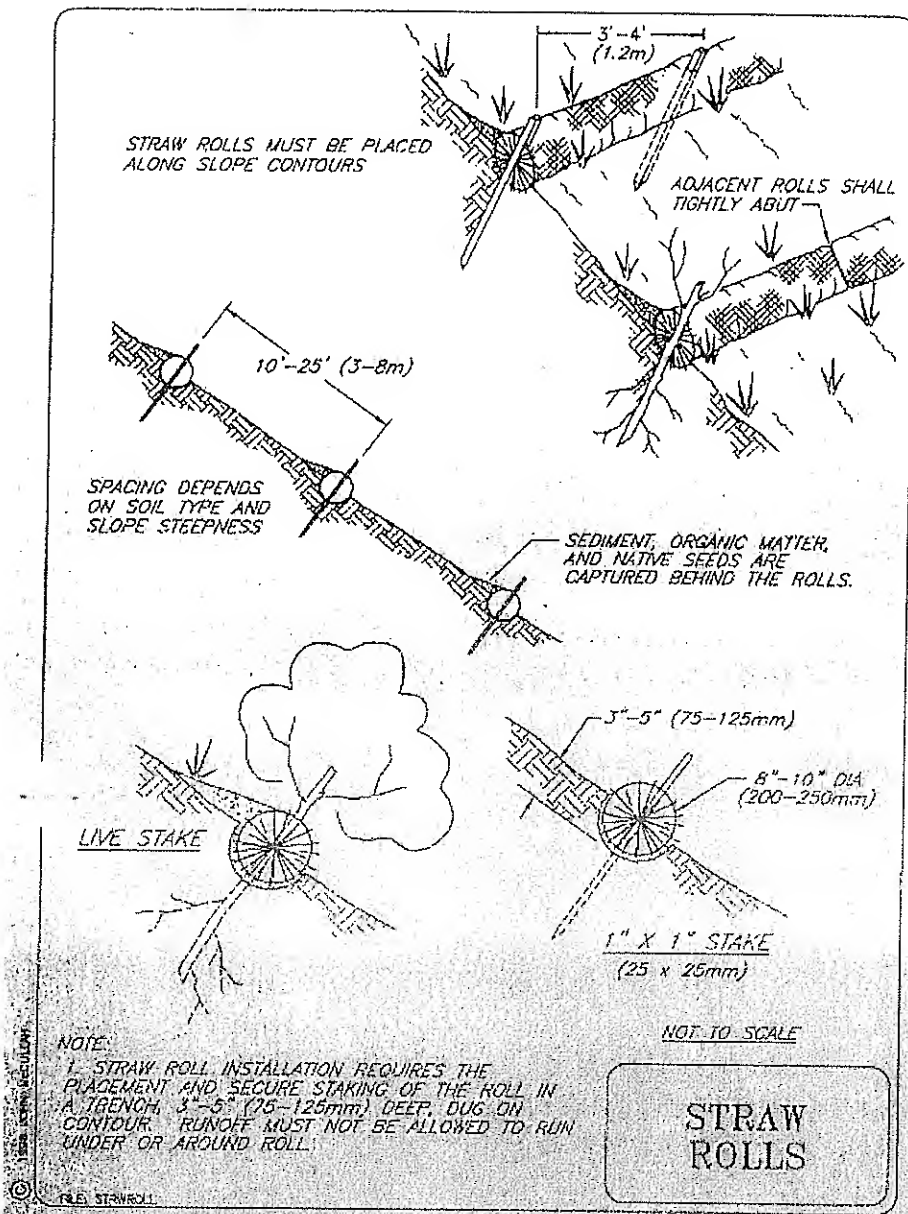
The contract price paid per linear foot of Straw Wattles shall include full compensation for furnishing all labor, materials, including wood stakes, tools, equipment, and incidentals, and for doing all the work involved in furnishing and installing Straw Wattles, complete in place, including furnishing and installing the wood stakes, as shown on the plans and directed by the Engineer.

FOR MORE INFORMATION CONTACT:

California Straw Works

Phone/FAX: (916) 453-1456 E-mail: strawwattles@worldnet.att.net

BMP: Wattle



General Description/Purpose - Straw rolls are manufactured from straw that is wrapped in tubular black plastic netting. They are approximately 8 inches (200 mm) in diameter by 25-30 feet (8-9 m) long. Rolls are placed and staked along the contour of newly constructed or disturbed slopes.

Straw rolls are intended to capture and keep sediment on the slopes. Straw rolls are useful to temporarily stabilize slopes by reducing soil creep and sheet and rill erosion until permanent vegetation can get established. They catch soil material that moves down the slope by the freeze/thaw processes. Organic matter and native seeds are trapped behind the rolls, which provide a stable medium for germination. Rolls trap fertile topsoil and retain moisture from rainfall, which aids in growth of tree seedlings planted along the upslope side of the rolls.

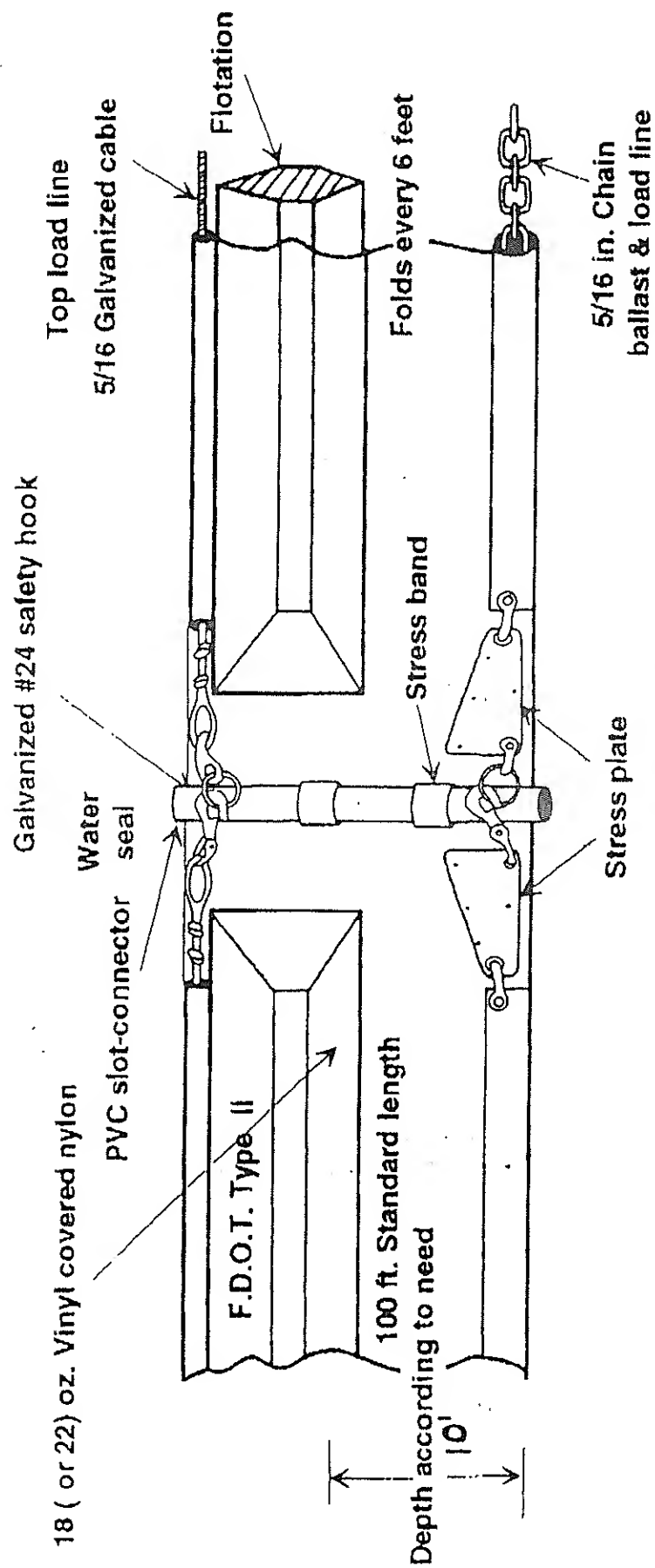
Design Considerations - Sites appropriate for straw rolls are:

- ◆ slopes susceptible to sheet and rill erosion;
- ◆ slopes producing dry ravel;
- ◆ slopes susceptible to freeze/thaw activity; or slopes difficult to vegetate because of soil movement. Straw rolls are not intended for use in concentrated flow situations.

Construction Specifications:

- ◆ Prepare the slope before the wattling procedure is started.
- ◆ Shallow gullies should be smoothed as work progresses.
- ◆ Dig small trenches across the slope on contour, to place rolls in. The trench should be deep enough to accommodate half the thickness of the roll. When the soil is loose and uncompacted, the trench should be deep enough to bury the roll 2/3 of its thickness because the ground will settle.
- ◆ It is critical that rolls are installed perpendicular to water movement, parallel to the slope contour.
- ◆ Start building trenches and install rolls from the bottom of the slope and work up.
Construct trenches at contour intervals of 3-12 feet (1-4 m) apart depending on steepness of slope. The steeper the slope, the closer together the trenches.
- ◆ Lay the roll along the trenches fitting it snugly against the soil. Make sure no gaps exist between the soil and the straw wattle.
- ◆ Use a straight bar to drive holes through the wattle and into the soil for the willow or wooden stakes.

- ◆ Drive the stake through prepared hole into soil. Leave only 1 or 2 inches (25 or 51 mm) of stake exposed above roll.
- ◆ If using willow stakes refer to Live Staking BMP.
- ◆ Install stakes at least every 4 feet (1.2 m) apart through the wattle. Additional stakes may be driven on the downslope side of the trenches on highly erosive or very steep slopes



SILT CURTAIN

THE PORTADAM SYSTEM

INTRODUCTION:

The "PORTADAM" is a patented cofferdam or diversion system used in water to nine feet deep for all types of excavation, construction or inspection where a dry work area is required. Because the system consists of individual steel support members and flexible fabric membrane, almost any configuration can be arranged, including straight across overflow weirs, complete four-sided box or a three sided arrangement with one side open to the beach for easy access of heavy equipment.

Alternately, the system can easily be inverted to form a retention basin. The high strength fabric membrane is inert and can be used in many fluids other than water.

This system was originally developed to comply with strict government controls of construction in the nations inland waterways. PORTADAM can be used in place of sheet piling, sandbags and earth fill construction methods to reduce siltation and introduction of hazardous materials into the water and is completely removeable and re-usable.

CONCEPT:

The concept is to utilize the mechanical and resistive properties of modern synthetic fabrics to provide both temporary and semi-permanent barriers and weirs for fluid damming and control.

System support is provided by welded steel members (fig. 1) designed to transfer fluid loading to a near vertical downward load, thereby reducing lateral forces.

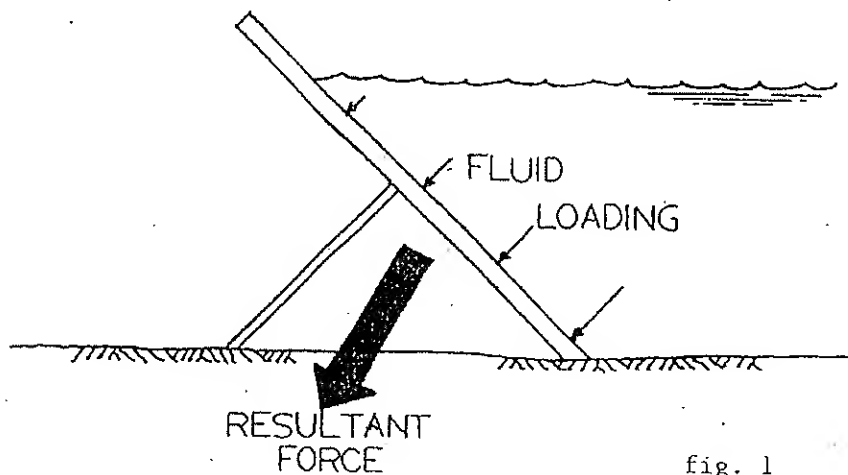


fig. 1

This design eliminates the need for internal cross bracing or heavy anchorage and provides an obstruction-free work area. Individual framing permits light handling loads and more flexibility over irregular bottom contours.

Impervious fabric membrane provides the waterstop when positioned along the diagonal face around the perimeter of the framework assembly installed. The tailored fabric membrane consists of a nylon reinforced vinyl upper portion for strength between steel frames and a lower section of lighter, flexible fabric extending out across the riverbed to provide sealing by hydrostatic pressure.

ATTACHMENT 2

**SITE INSPECTION AND
MONITORING REPORT FORMS**

STORMWATER MANAGEMENT PLAN INSPECTION CHECKLIST

SITE 27 - FORMER NAVAL AIR STATION MOFFET FIELD

Name/Title of Inspector: _____

Date of Inspection: _____ **Time of Inspection:** __:__ AM/PM

Type of Inspection: Pre-Precipitation/Post-Precipitation

Weather Conditions: _____

Start of Rainfall (Date/Time): _____

End of Rainfall (Date/Time): _____

Total Recorded Precipitation: _____ inches

- 1. Description of Area Under Maintenance/Construction Contributing to Stormwater Runoff (include location of maintenance area; BMPs in place; type of maintenance activity; condition of stormwater discharge structures):**

[illegible]

2. Describe changes to the Stormwater Control Structures, if different than the SWMP (Detention basin,V-ditches, CMP inlets, culverts, etc.)

3. Are the Stormwater Control Structures free of debris?

4. Are there areas of erosion?

5. Are there areas of ponding?

6. Are drainage and erosion controls placed around any stockpiled areas?

7. Are the BMPs in place adequate, properly maintained, or implemented?

8. Are additional BMPs required to control stormwater pollution runoff?

9. Recommended corrective actions for SWMP/stormwater control system:

10. Is a Corrective Action Plan required?

11. Comments:

BMPS FOR SITE 27 NORTHERN CHANNEL

Inspected by: _____

Y - YES N - NO

Date: _____

(REF. SWMP FIGURE 3-2)

ITEMS	IN PLACE	CLEARED	ADEQUATE	NEEDS IMPROVEMENT
Discharge points at northeast corner of site				
Sandbags around inlet				
Berms along western border of site				
Berms along northern border of site				
Equipment and material staging area				
Stockpile area fiber roll/haybale/berm				
Silt fence along northern haul road of site				
Silt fence along southern Patrol Road border of site				
Silt fence along western portion of stockpile site				
Active construction area silt fence				
Stabilized construction entrance				
Off-site mud tracking concerns				
General grading to prevent ponding				
Trackwalk of bare soil areas				
Grade to drain				
Floating sediment curtains in channel				
Sediment traps in North Patrol Road Ditch				
Sediment/silt fence in Marriage Road				

ATTACHMENT 3

**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
GENERAL PERMIT - CONSTRUCTION**

**STATE WATER RESOURCES CONTROL BOARD (SWRCB)
ORDER NO. 99 - 08 - DWQ
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
GENERAL PERMIT NO. CAS000002**

**WASTE DISCHARGE REQUIREMENTS (WDRS)
FOR
DISCHARGES OF STORM WATER RUNOFF ASSOCIATED WITH
CONSTRUCTION ACTIVITY**

The State Water Resources Control Board finds that:

1. Federal regulations for controlling pollutants in storm water runoff discharges were promulgated by the U.S. Environmental Protection Agency (USEPA) on November 16, 1990 (40 Code of Federal Regulations (CFR) Parts 122, 123, and 124). The regulations require discharges of storm water to surface waters associated with construction activity including clearing, grading, and excavation activities (except operations that result in disturbance of less than five acres of total land area and which are not part of a larger common-plan of development or sale) to obtain an NPDES permit and to implement Best Available Technology Economically Achievable (BAT) and Best Conventional Pollutant Control Technology (BCT) to reduce or eliminate storm water pollution.
2. This General Permit regulates pollutants in discharges of storm water associated with construction activity (storm water discharges) to surface waters, except from those areas on Tribal Lands; Lake Tahoe Hydrologic Unit; construction projects which disturb less than five acres, unless part of a larger common plan of development or sale; and storm water discharges which are determined ineligible for coverage under this General Permit by the California Regional Water Quality Control Boards (RWQCBs). Attachment 1 contains addresses and telephone numbers of each RWQCB office.
3. This General Permit does not preempt or supersede the authority of local storm water management agencies to prohibit, restrict, or control storm water discharges to separate storm sewer systems or other watercourses within their jurisdiction, as allowed by State and Federal law.

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4. To obtain authorization for proposed storm water discharges to surface waters, pursuant to this General Permit, the landowner (discharger) must submit a Notice of Intent (NOI) with a vicinity map and the appropriate fee to the SWRCB prior to commencement of construction activities. In addition, coverage under this General Permit shall not occur until the applicant develops a Storm Water Pollution Prevention Plan (SWPPP) in accordance with the requirements of Section A of this permit for the project. For proposed construction activity conducted on easements or on nearby property by agreement or permission, or by an owner or lessee of a mineral estate (oil, gas, geothermal, aggregate, precious metals, and/or industrial minerals) entitled to conduct the activities, the entity responsible for the construction activity must submit the NOI and filing fee and shall be responsible for development of the SWPPP.
5. If an individual NPDES Permit is issued to a discharger otherwise subject to this General Permit or if an alternative General Permit is subsequently adopted which covers storm water discharges regulated by this General Permit, the applicability of this General Permit to such discharges is automatically terminated on the effective date of the individual permit or the date of approval for coverage under the subsequent General Permit.
6. This action to adopt an NPDES permit is exempt from the provisions of the California Environmental Quality Act (Public Resources Code Section 21100, et seq.) in accordance with section 13389 of the California Water Code.
7. The SWRCB adopted the California Ocean Plan, and the RWQCBs have adopted and the SWRCB has approved Water Quality Control Plans (Basin Plans). Dischargers regulated by this General Permit must comply with the water quality standards in these Basin Plans and subsequent amendments thereto.
8. The SWRCB finds storm water discharges associated with construction activity to be a potential significant sources of pollutants. Furthermore, the SWRCB finds that storm water discharges associated with construction activities have the reasonable potential to cause or contribute to an excursion above water quality standards for sediment in the water bodies listed in Attachment 3 to this permit.
9. It is not feasible at this time to establish numeric effluent limitations for pollutants in storm water discharges from construction activities. Instead, the provisions of this General Permit require implementation of Best Management Practices (BMPs) to control and abate the discharge of pollutants in storm water discharges.
10. Discharges of non-storm water may be necessary for the completion of certain construction projects. Such discharges include, but are not limited to: irrigation of vegetative erosion control measures, pipe flushing and testing, street cleaning, and dewatering. Such discharges are authorized by this General Permit as long as they (a) do comply with Section A.9 of this General Permit, (b) do not cause or contribute to violation of any water quality standard, (c) do not violate any other provision of this General Permit, (d) do not require a non-storm water permit as issued by some RWQCBs,

and (e) are not prohibited by a Basin Plan. If a non-storm water discharge is subject to a separate permit adopted by a RWQCB, the discharge must additionally be authorized by the RWQCB permit.

11. Following adoption of this General Permit, the RWQCBs shall enforce the provisions herein including the monitoring and reporting requirements.
12. Following public notice in accordance with State and Federal laws and regulations, the SWRCB in a public meeting on June 8, 1998, heard and considered all comments. The SWRCB has prepared written responses to all significant comments.
13. This Order is an NPDES permit in compliance with section 402 of the Clean Water Act (CWA) and shall take effect upon adoption by the SWRCB provided the Regional Administrator of the USEPA has no objection. If the USEPA Regional Administrator objects to its issuance, the General Permit shall not become effective until such objection is withdrawn.
14. This General Permit does not authorize discharges of fill or dredged material regulated by the U.S. Army Corps of Engineers under CWA section 404 and does not constitute a waiver of water quality certification under CWA section 401.

IT IS HEREBY ORDERED that all dischargers who file an NOI indicating their intention to be regulated under the provisions of this General Permit shall comply with the following:

A. DISCHARGE PROHIBITIONS:

1. Authorization pursuant to this General Permit does not constitute an exemption to applicable discharge prohibitions prescribed in Basin Plans, as implemented by the nine RWQCBs.
2. Discharges of material other than storm water which are not otherwise authorized by an NPDES permit to a separate storm sewer system (MS4) or waters of the nation are prohibited, except as allowed in Special Provisions for Construction Activity, C.3.
3. Storm water discharges shall not cause or threaten to cause pollution, contamination, or nuisance.
4. Storm water discharges regulated by this General Permit shall not contain a hazardous substance equal to or in excess of a reportable quantity listed in 40 CFR Part 117 and/or 40 CFR Part 302.

B. RECEIVING WATER LIMITATIONS:

1. Storm water discharges and authorized nonstorm water discharges to any surface or ground water shall not adversely impact human health or the environment.
2. The SWPPP developed for the construction activity covered by this General Permit shall be designed and implemented such that storm water discharges and authorized nonstorm water discharges shall not cause or contribute to an exceedance of any applicable water quality standards contained in a Statewide Water Quality Control Plan and/or the applicable RWQCB's Basin Plan.
3. Should it be determined by the discharger, SWRCB, or RWQCB that storm water discharges and/or authorized nonstorm water discharges are causing or contributing to an exceedance of an applicable water quality standard, the discharger shall:
 - a. Implement corrective measures immediately following discovery that water quality standards were exceeded, followed by notification to the RWQCB by telephone as soon as possible but no later than 48 hours after the discharge has been discovered. This notification shall be followed by a report within 14-calender days to the appropriate RWQCB, unless otherwise directed by the RWQCB, describing (1) the nature and cause of the water quality standard exceedance; (2) the BMPs currently being implemented; (3) any additional BMPs which will be implemented to prevent or reduce pollutants that are causing or contributing to the exceedance of water quality standards; and (4) any maintenance or repair of BMPs. This report shall include an implementation schedule for corrective actions and shall describe the actions taken to reduce the pollutants causing or contributing to the exceedance.
 - b. The discharger shall revise its SWPPP and monitoring program immediately after the report to the RWQCB to incorporate the additional BMPs that have been and will be implemented, the implementation schedule, and any additional monitoring needed.
 - c. Nothing in this section shall prevent the appropriate RWQCB from enforcing any provisions of this General Permit while the discharger prepares and implements the above report.

C. SPECIAL PROVISIONS FOR CONSTRUCTION ACTIVITY:

1. All dischargers shall file an NOI and pay the appropriate fee for construction activities conducted at each site as required by Attachment 2: Notice of Intent-- General Instructions.
2. All dischargers shall develop and implement a SWPPP in accordance with

Section A: Storm Water Pollution Prevention Plan. The discharger shall implement controls to reduce pollutants in storm water discharges from their construction sites to the BAT/BCT performance standard.

3. Discharges of non-storm water are authorized only where they do not cause or contribute to a violation of any water quality standard and are controlled through implementation of appropriate BMPs for elimination or reduction of pollutants. Implementation of appropriate BMPs is a condition for authorization of non-storm water discharges. Non-storm water discharges and the BMPs appropriate for their control must be described in the SWPPP. Wherever feasible, alternatives which do not result in discharge of nonstorm water shall be implemented in accordance with Section A.9. of the SWPPP requirements.
4. All dischargers shall develop and implement a monitoring program and reporting plan in accordance with Section B: Monitoring Program and Reporting Requirements.
5. All dischargers shall comply with the lawful requirements of municipalities, counties, drainage districts, and other local agencies regarding discharges of storm water to separate storm sewer systems or other watercourses under their jurisdiction, including applicable requirements in municipal storm water management programs developed to comply with NPDES permits issued by the RWQCBs to local agencies.
6. All dischargers shall comply with the standard provisions and reporting requirements contained in Section C: Standard Provisions.
7. The discharger may terminate coverage for a portion of the project under this General Permit when ownership of a portion of this project has been transferred or when a phase within this multi-phase project has been completed. When ownership has transferred, the discharger must submit to its RWQCB a Change of Information Form (COI) Attachment 4 with revised site map and the name, address and telephone number of the new owner(s). Upon transfer of title, the discharger should notify the new owner(s) of the need to obtain coverage under this General Permit. The new owner must comply with provisions of Sections A. 2. (c) and B. 2. (b) of this General Permit. To terminate coverage for a portion of the project when a phase has been completed, the discharger must submit to its RWQCB a COI with a revised map that identifies the newly delineated site.
8. The discharger may terminate coverage under this General Permit for a complete project by submitting to its RWQCB a Notice of Termination Form (NOT), and the post-construction BMPs plan according to Section A.10 of this General

Permit. Note that a construction project is considered complete only when all portions of the site have been transferred to a new owner; or the following conditions have been met:

- a. There is no potential for construction related storm water pollution,
- b. All elements of the SWPPP have been completed,
- c. Construction materials and waste have been disposed of properly,
- d. The site is in compliance with all local storm water management requirements, and
- e. A post-construction storm water management plan is in place as described in the site's SWPPP.

9. This General Permit expires five years from the date of adoption.

D. REGIONAL WATER QUALITY CONTROL BOARD (RWQCB) AUTHORITIES:

1. RWQCBs shall:
 - a. Implement the provisions of this General Permit. Implementation of this General Permit may include, but is not limited to requesting the submittal of SWPPPS, reviewing SWPPPs, reviewing monitoring reports, conducting compliance inspections, and taking enforcement actions.
 - b. Issue permits as they deem appropriate to individual dischargers, categories of dischargers, or dischargers in a geographic area. Upon issuance of such permits by a RWQCB, the affected dischargers shall no longer be regulated by this General Permit.
2. RWQCBs may require, on a case-by-case basis, the inclusion of an analysis of potential downstream impacts on receiving waterways due to the permitted construction.
3. RWQCBs may provide information to dischargers on the development and implementation of SWPPPs and monitoring programs and may require revisions to SWPPPs and monitoring programs.
4. RWQCBs may require dischargers to retain records for more than three years.
5. RWQCBs may require additional monitoring and reporting program requirements including sampling and analysis of discharges to water bodies listed in Attachment 3 to this permit. Additional requirements imposed by the RWQCB should be consistent with the overall monitoring effort in the receiving waters.

6. RWQCBs may issue individual NPDES permits for those construction activities found to be ineligible for coverage under this permit.

CERTIFICATION

The undersigned, Administrative Assistant to the Board, does hereby certify that the foregoing is a full, true, and correct copy of an order duly and regularly adopted at a meeting of the State Water Resources Control Board held on August 19, 1999.

AYE: James M. Stubchaer
Mary Jane Forster
John W. Brown
Arthur G. Baggett, Jr.

NO: None

ABSENT: None

ABSTAIN: None

/s/
Maureen Marché
Administrative Assistant to the Board

SECTION A: STORM WATER POLLUTION PREVENTION PLAN

1. Objectives

A Storm Water Pollution Prevention Plan (SWPPP) shall be developed and implemented to address the specific circumstances for each construction site covered by this General Permit. The SWPPP shall be certified in accordance with the signatory requirements of section C, Standard Provision for Construction Activities (9). The SWPPP shall be developed and amended or revised, when necessary, to meet the following objectives:

- a. Identify all pollutant sources including sources of sediment that may affect the quality of storm water discharges associated with construction activity (storm water discharges) from the construction site, and
- b. Identify non-storm water discharges, and
- c. Identify, construct, implement in accordance with a time schedule, and maintain Best Management Practices (BMPs) to reduce or eliminate pollutants in storm water discharges and authorized nonstorm water discharges from the construction site during construction, and
- d. Develop a maintenance schedule for BMPs installed during construction designed to reduce or eliminate pollutants after construction is completed (post-construction BMPs).

2. Implementation Schedule

- a. For construction activity commencing on or after adoption of this General Permit, the SWPPP shall be developed prior to the start of soil-disturbing activity in accordance with this Section and shall be implemented concurrently with commencement of soil-disturbing activities.
- b. Existing permittees engaging in construction activities covered under the terms of the previous General Construction Permit SWPPP (WQ Order No.92-08-DWQ) shall continue to implement their existing SWPPP and shall implement any necessary revisions to their SWPPP in accordance with this Section of the General Permit in a timely manner, but in no case more than 90-calender days from the date of adoption of this General Permit.
- c. For ongoing construction activity involving a change of ownership of property, the new owner shall review the existing SWPPP and amend if necessary, or develop a new SWPPP within 45-calender days.

3. Availability

The SWPPP shall remain on the construction site while the site is under construction during working hours, commencing with the initial construction activity and ending with termination of coverage under the General Permit.

4. Required Changes

- a. The discharger shall amend the SWPPP whenever there is a change in construction or operations which may affect the discharge of pollutants to surface waters, ground waters, or a municipal separate storm sewer system (MS4). The SWPPP shall also be amended if the discharger violates any condition of this General Permit or has not achieved the general objective of reducing or eliminating pollutants in storm water discharges. If the RWQCB determines that the discharger is in violation of this General Permit, the SWPPP shall be amended and implemented in a timely manner, but in no case more than 14-calendar days after notification by the RWQCB. All amendments should be dated and directly attached to the SWPPP.
- b. The RWQCB or local agency with the concurrence of the RWQCB may require the discharger to amend the SWPPP.

5. Source Identification

The SWPPP shall include: (a) project information and (b) pollutant source identification combined with an itemization of those BMPs specifically chosen to control the pollutants listed.

a. Project Information

- (1) The SWPPP shall include a vicinity map locating the project site with respect to easily identifiable major roadways, geographic features, or landmarks. At a minimum, the map must show the construction site perimeter, the geographic features surrounding the site, and the general topography.
- (2) The SWPPP shall include a site map(s) which shows the construction project in detail, including the existing and planned paved areas and buildings.
 - (a) At a minimum, the map must show the construction site perimeter; existing and proposed buildings, lots, roadways, storm water collection and discharge points; general topography both before and after construction; and the anticipated discharge location(s) where the storm water from the construction site discharges to a municipal storm sewer system or other water body.

- (b) The drainage patterns across the project area must clearly be shown on the map, and the map must extend as far outside the site perimeter as necessary to illustrate the relevant drainage areas. Where relevant drainage areas are too large to depict on the map, map notes or inserts illustrating the upstream drainage areas are sufficient.
 - (c) Temporary on-site drainages to carry concentrated flow shall be selected to comply with local ordinances, to control erosion, to return flows to their natural drainage courses, and to prevent damage to downstream properties.
3. Information presented in the SWPPP may be represented either by narrative or by graphics. Where possible, narrative descriptions should be plan notes. Narrative descriptions which do not lend themselves to plan notes can be contained in a separate document which must be referenced on the plan.

b. Pollutant Source and BMP Identification

The SWPPP shall include a description of potential sources which are likely to add pollutants to storm water discharges or which may result in nonstorm water discharges from the construction site. Discharges originating from off-site which flow across or through areas disturbed by construction that may contain pollutants should be reported to the RWQCB.

The SWPPP shall:

- (1) Show drainage patterns and slopes anticipated after major grading activities are completed. Runoff from off-site areas should be prevented from flowing through areas that have been disturbed by construction unless appropriate conveyance systems are in place. The amount of anticipated storm water run-on must be considered to determine the appropriateness of the BMPs chosen. Show all calculations for anticipated storm water run-on, and describe all BMPs implemented to divert off-site drainage described in section A. 5 a. (2) (c) around or through the construction project.
- (2) Show the drainage patterns into each on-site storm water inlet point or receiving water. Show or describe the BMPs that will protect operational storm water inlets or receiving waters from contaminated discharges other than sediment discharges, such as, but not limited to: storm water with elevated pH levels from contact with soil amendments such as lime or gypsum; slurry from sawcutting of concrete or asphalt; washing of exposed aggregate concrete; concrete rinse water; building washing

operations; equipment washing operations; minor street washing associated with street delineation; and/or sealing and paving activities occurring during rains.

- (3) Show existing site features that, as a result of known past usage, may contribute pollutants to storm water, (e.g., toxic materials that are known to have been treated, stored, disposed, spilled, or leaked onto the construction site). Show or describe the BMPs implemented to minimize the exposure of storm water to contaminated soil or toxic materials.
- (4) Show areas designated for the (a) storage of soil or waste, (b) vehicle storage and service areas, (c) construction material loading, unloading, and access areas, (d) equipment storage, cleaning, and maintenance areas.
- (5) Describe the BMPs for control of discharges from waste handling and disposal areas and methods of on-site storage and disposal of construction materials and construction waste. Describe the BMPs designed to minimize or eliminate the exposure of storm water to construction materials, equipment, vehicles, waste storage areas, or service areas. The BMPs described shall be in compliance with Federal, State, and local laws, regulations, and ordinances.
- (6) Describe all post-construction BMPs for the project, and show the location of each BMP on the map. (Post-construction BMPs consist of permanent features designed to minimize pollutant discharges, including sediment, from the site after construction has been completed.) Also, describe the agency or parties to be the responsible party for long-term maintenance of these BMPs.

c. Additional Information

- (1) The SWPPP shall include a narrative description of pollutant sources and BMPs that cannot be adequately communicated or identified on the site map. In addition, a narrative description of preconstruction control practices (if any) to reduce sediment and other pollutants in storm water discharges shall be included.
- (2) The SWPPP shall include an inventory of all materials used and activities performed during construction that have the potential to contribute to the discharge of pollutants other than sediment in storm water. Describe the BMPs selected and the basis for their selection to eliminate or reduce these pollutants in the storm water discharges.
- (3) The SWPPP shall include the following information regarding the construction site surface area: the size (in acres or square feet), the runoff

coefficient before and after construction, and the percentage that is impervious (e.g., paved, roofed, etc.) before and after construction.

- (4) The SWPPP shall include a copy of the NOI, and the Waste Discharge Identification (WDID) number. Should a WDID number not be received from the SWRCB at the time construction commences, the discharger shall include proof of mailing of the NOI, e.g., certified mail receipt, copy of check, express mail receipt, etc.
- (5) The SWPPP shall include a construction activity schedule which describes all major activities such as mass grading, paving, lot or parcel improvements at the site and the proposed time frame to conduct those activities.
- (6) The SWPPP shall list the name and telephone number of the qualified person(s) who have been assigned responsibility for prestorm, poststorm, and storm event BMP inspections; and the qualified person(s) assigned responsibility to ensure full compliance with the permit and implementation of all elements of the SWPPP, including the preparation of the annual compliance evaluation and the elimination of all unauthorized discharges.

6. Erosion Control

Erosion control, also referred to as "soil stabilization" is the most effective way to retain soil and sediment on the construction site. The most efficient way to address erosion control is to preserve existing vegetation where feasible, to limit disturbance, and to stabilize and revegetate disturbed areas as soon as possible after grading or construction. Particular attention must be paid to large mass-graded sites where the potential for soil exposure to the erosive effects of rainfall and wind is great. Mass graded construction sites may be exposed for several years while the project is being built out. Thus, there is potential for significant sediment discharge from the site to surface waters.

At a minimum, the discharger/operator must implement an effective combination of erosion and sediment control on all disturbed areas during the rainy season. These disturbed areas include rough graded roadways, slopes, and building pads. Until permanent vegetation is established, soil cover is the most cost-effective and expeditious method to protect soil particles from detachment and transport by rainfall. Temporary soil stabilization can be the single-most important factor in reducing erosion at construction sites. The discharger shall consider measures such as: covering with mulch, temporary seeding, soil stabilizers, binders, fiber rolls or blankets, temporary vegetation, permanent seeding, and a variety of other measures.

The SWPPP shall include a description of the erosion control practices, including a time schedule, to be implemented during construction to minimize erosion on disturbed areas of a construction site. The discharger must consider the full range of erosion control

BMPs. The discharger must consider any additional site-specific and seasonal conditions when selecting and implementing appropriate BMPs. The above listed erosion control measures are examples of what should be considered and are not exclusive of new or innovative approaches currently available or being developed.

- a. The SWPPP shall include:
 - (1) An outline of the areas of vegetative soil cover or native vegetation onsite which will remain undisturbed during the construction project.
 - (2) An outline of all areas of soil disturbance including cut or fill areas which will be stabilized during the rainy season by temporary or permanent erosion control measures, such as seeding, mulch, or blankets, etc.
 - (3) An outline of the areas of soil disturbance, cut, or fill which will be left exposed during any part of the rainy season, representing areas of potential soil erosion where sediment control BMPs are required to be used during construction.
 - (4) A proposed schedule for the implementation of erosion control measures.
- b. The SWPPP shall include a description of the BMPs and control practices to be used for both temporary and permanent erosion control measures.
- c. The SWPPP shall include a description of the BMPs to reduce wind erosion at all times, with particular attention paid to stock-piled materials.

7. Stabilization

- (1) All disturbed areas of the construction site must be stabilized. Final stabilization for the purposes of submitting a NOT is satisfied when:
 - All soil disturbing activities are completed AND EITHER OF THE TWO FOLLOWING CRITERIA ARE MET:
 - A uniform vegetative cover with 70 percent coverage has been established OR:
 - equivalent stabilization measures have been employed. These measures include the use of such BMPs as blankets, reinforced channel liners, soil cement, fiber matrices, geotextiles, or other erosion resistant soil coverings or treatments.
- (2) Where background native vegetation covers less than 100 percent of the surface, such as in arid areas, the 70 percent coverage criteria is adjusted as follows: If the native vegetation covers 50 percent of the ground

surface, 70 percent of 50 percent (.70 X .50=.35) would require 35 percent total uniform surface coverage.

8. Sediment Control

The SWPPP shall include a description or illustration of BMPs which will be implemented to prevent a net increase of sediment load in storm water discharge relative to preconstruction levels. Sediment control BMPs are required at appropriate locations along the site perimeter and at all operational internal inlets to the storm drain system at all times during the rainy season. Sediment control practices may include filtration devices and barriers (such as fiber rolls, silt fence, straw bale barriers, and gravel inlet filters) and/or settling devices (such as sediment traps or basins). Effective filtration devices, barriers, and settling devices shall be selected, installed and maintained properly. A proposed schedule for deployment of sediment control BMPs shall be included in the SWPPP. These are the most basic measures to prevent sediment from leaving the project site and moving into receiving waters. Limited exemptions may be authorized by the RWQCB when work on active areas precludes the use of sediment control BMPs temporarily. Under these conditions, the SWPPP must describe a plan to establish perimeter controls prior to the onset of rain.

During the nonrainy season, the discharger is responsible for ensuring that adequate sediment control materials are available to control sediment discharges at the downgrade perimeter and operational inlets in the event of a predicted storm. The discharger shall consider a full range of sediment controls, in addition to the controls listed above, such as straw bale dikes, earth dikes, brush barriers, drainage swales, check dams, subsurface drain, sandbag dikes, fiber rolls, or other controls. At a minimum, the discharger/operator must implement an effective combination of erosion and sediment control on all disturbed areas during the rainy season.

If the discharger chooses to rely on sediment basins for treatment purposes, sediment basins shall, at a minimum, be designed and maintained as follows:

Option 1: Pursuant to local ordinance for sediment basin design and maintenance, provided that the design efficiency is as protective or more protective of water quality than Option 3.

OR

Option 2: Sediment basin(s), as measured from the bottom of the basin to the principal outlet, shall have at least a capacity equivalent to 3,600 cubic feet of storage per acre draining into the sediment basin. The length of the basin shall be more than twice the width of the basin. The length is determined by measuring the distance between the inlet and the outlet; and the depth must not be less than three feet nor greater than five feet for safety reasons and for maximum efficiency.

OR

Option 3: Sediment basin(s) shall be designed using the standard equation:

$$As = 1.2Q/Vs$$

Where: As is the minimum surface area for trapping soil particles of a certain size; Vs is the settling velocity of the design particle size chosen; and $Q = C \times I \times A$ where Q is the discharge rate measured in cubic feet per second; C is the runoff coefficient; I is the precipitation intensity for the 10-year, 6-hour rain event and A is the area draining into the sediment basin in acres. The design particle size shall be the smallest soil grain size determined by wet sieve analysis, or the fine silt sized (0.01mm) particle, and the Vs used shall be 100 percent of the calculated settling velocity.

The length is determined by measuring the distance between the inlet and the outlet; the length shall be more than twice the dimension as the width; the depth shall not be less than three feet nor greater than five feet for safety reasons and for maximum efficiency (two feet of storage, two feet of capacity). The basin(s) shall be located on the site where it can be maintained on a year-round basis and shall be maintained on a schedule to retain the two feet of capacity;

OR

Option 4: The use of an equivalent surface area design or equation, provided that the design efficiency is as protective or more protective of water quality than Option 3.

A sediment basin shall have a means for dewatering within 7-calendar days following a storm event. Sediment basins may be fenced if safety (worker or public) is a concern.

The outflow from a sediment basin that discharges into a natural drainage shall be provided with outlet protection to prevent erosion and scour of the embankment and channel.

The discharger must consider any additional site-specific and seasonal conditions when selecting and designing sediment control BMPs. The above listed sediment control measures are examples of what should be considered and are not exclusive of new or innovative approaches currently available or being developed.

The SWPPP shall include a description of the BMPs to reduce the tracking of sediment onto public or private roads at all times. These public and private roads shall be inspected and cleaned as necessary. Road cleaning BMPs shall be discussed in the SWPPP and will not rely on the washing of accumulated sediment or silt into the storm drain system.

9. Non-Storm Water Management

Describe all non-storm water discharges to receiving waters that are proposed for the construction project. Non-storm water discharges should be eliminated or reduced to the extent feasible. Include the locations of such discharges and descriptions of all BMPs designed for the control of pollutants in such discharges. Onetime discharges shall be monitored during the time that such discharges are occurring. A qualified person should be assigned the responsibility for ensuring that no materials other than storm water are discharged in quantities which will have an adverse effect on receiving waters or storm drain systems (consistent with BAT/BCT), and the name and contact number of that person should be included in the SWPPP document.

Discharging sediment-laden water which will cause or contribute to an exceedance of the applicable RWQCB's Basin Plan from a dewatering site or sediment basin into any receiving water or storm drain without filtration or equivalent treatment is prohibited.

10. Post-Construction Storm Water Management

The SWPPP shall include descriptions of the BMPs to reduce pollutants in storm water discharges after all construction phases have been completed at the site (Post-Construction BMPs). Post-Construction BMPs include the minimization of land disturbance, the minimization of impervious surfaces, treatment of storm water runoff using infiltration, detention/retention, biofilter BMPs, use of efficient irrigation systems, ensuring that interior drains are not connected to a storm sewer system, and appropriately designed and constructed energy dissipation devices. These must be consistent with all local post-construction storm water management requirements, policies, and guidelines. The discharger must consider site-specific and seasonal conditions when designing the control practices. Operation and maintenance of control practices after construction is completed shall be addressed, including short-and long-term funding sources and the responsible party.

11. Maintenance, Inspection, and Repair

The SWPPP shall include a discussion of the program to inspect and maintain all BMPs as identified in the site plan or other narrative documents throughout the entire duration of the project. A qualified person will be assigned the responsibility to conduct inspections. The name and telephone number of that person shall be listed in the SWPPP document. Inspections will be performed before and after storm events and once each 24-hour period during extended storm events to identify BMP effectiveness and implement repairs or design changes as soon as feasible depending upon field conditions. Equipment, materials, and workers must be available for rapid response to failures and emergencies. All corrective maintenance to BMPs shall be performed as soon as possible after the conclusion of each storm depending upon worker safety.

For each inspection required above, the discharger shall complete an inspection checklist. At a minimum, an inspection checklist shall include:

- a. Inspection date.
- b. Weather information: best estimate of beginning of storm event, duration of event, time elapsed since last storm, and approximate amount of rainfall (inches).
- c. A description of any inadequate BMPs.
- d. If it is possible to safely access during inclement weather, list observations of all BMPs: erosion controls, sediment controls, chemical and waste controls, and non-storm water controls. Otherwise, list result of visual inspection at relevant outfall, discharge point, or downstream location and projected required maintenance activities.
- e. Corrective actions required, including any changes to SWPPP necessary and implementation dates.
- f. Inspectors name, title, and signature.

The dischargers shall prepare their inspection checklists using the inspection checklist form provided by the SWRCB or RWQCB or on forms that contain the equivalent information.

12. Training

Individuals responsible for SWPPP preparation, implementation, and permit compliance shall be appropriately trained, and the SWPPP shall document all training. This includes those personnel responsible for installation, inspection, maintenance, and repair of BMPs. Those responsible for overseeing, revising, and amending the SWPPP shall also document their training. Training should be both formal and informal, occur on an ongoing basis when it is appropriate and convenient, and should include

training/workshops offered by the SWRCB, RWQCB, or other locally recognized agencies or professional organizations.

13. List of Contractors/Subcontractors

The SWPPP shall include a list of names of all contractors, (or subcontractors) and individuals responsible for implementation of the SWPPP. This list should include telephone numbers and addresses. Specific areas of responsibility of each subcontractor and emergency contact numbers should also be included.

14. Other Plans

This SWPPP may incorporate by reference the appropriate elements of other plans required by local, State, or Federal agencies. A copy of any requirements incorporated by reference shall be kept at the construction site.

15. Public Access

The SWPPP shall be provided, upon request, to the RWQCB. The SWPPP is considered a report that shall be available to the public by the RWQCB under section 308(b) of the Clean Water Act.

16. Preparer Certification

The SWPPP and each amendment shall be signed by the landowner (discharger) or his representative and include the date of initial preparation and the date of each amendment.

SECTION B: MONITORING PROGRAM AND REPORTING REQUIREMENTS

1. Required Changes

The RWQCB may require the discharger to conduct additional site inspections, to submit reports and certifications, or perform sampling and analysis.

2. Implementation

- a. The requirements of this Section shall be implemented at the time of commencement of construction activity (see also Section A. 2. Implementation Schedule). The discharger is responsible for implementing these requirements until construction activity is complete and the site is stabilized.
- b. For ongoing construction activity involving a change in ownership of property covered by this General Permit, the new owner must complete a NOI and implement the requirements of this Section concurrent with the change of ownership. For changes of information, the owner must follow instructions in C. 7. Special Provisions for Construction Activity of the General Permit.

3. Site Inspections

Qualified personnel shall conduct inspections of the construction site prior to anticipated storm events, during extended storm events, and after actual storm events to identify areas contributing to a discharge of storm water associated with construction activity. The name(s) and contact number(s) of the assigned inspection personnel shall be listed in the SWPPP. Pre-storm inspections are to ensure that BMPs are properly installed and maintained; post-storm inspections are to assure that the BMPs have functioned adequately. During extended storm events, inspections shall be required each 24-hour period. Best Management Practices (BMPs) shall be evaluated for adequacy and proper implementation and whether additional BMPs are required in accordance with the terms of the General Permit (see language in Section A. 11. Maintenance, Inspection, and Repair). Implementation of nonstorm water discharge BMPs shall be verified and their effectiveness evaluated. One time discharges of non-storm water shall be inspected when such discharges occur.

4. Compliance Certification

Each discharger or qualified assigned personnel listed by name and contact number in the SWPPP must certify annually that construction activities are in compliance with the requirements of this General Permit and the SWPPP. This Certification shall be based upon the site inspections required in Item 3 of this Section. The certification must be completed by July 1 of each year.

5. Noncompliance Reporting

Dischargers who cannot certify compliance, in accordance with Item 4 of this Section and/or who have had other instances of noncompliance excluding exceedances of water quality standards as defined in section B. 3. Receiving Water Limitations Language, shall notify the appropriate RWQCB within 30 days. Corrective measures should be implemented immediately following discovery that water quality standards were exceeded. The notifications shall identify the noncompliance event, including an initial assessment of any impact caused by the event; describe the actions necessary to achieve compliance; and include a time schedule subject to the modifications by the RWQCB indicating when compliance will be achieved. Noncompliance notifications must be submitted within 30-calendar days of identification of noncompliance.

6. Monitoring Records

Records of all inspections, compliance certifications, and noncompliance reporting must be retained for a period of at least three years from the date generated. With the exception of noncompliance reporting, dischargers are not required to submit these records.

SECTION C: STANDARD PROVISIONS FOR CONSTRUCTION ACTIVITY

1. Duty to Comply

The discharger must comply with all of the conditions of this General Permit. Any permit noncompliance constitutes a violation of the Clean Water Act (CWA) and the Porter-Cologne Water Quality Control Act and is grounds for enforcement action and/or removal from General Permit coverage.

The discharger shall comply with effluent standards or prohibitions established under Section 307(a) of the CWA for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if this General Permit has not yet been modified to incorporate the requirement.

2. General Permit Actions

This General Permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the discharger for a General Permit modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not annul any General Permit condition.

If any toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is promulgated under Section 307(a) of the CWA for a toxic pollutant which is present in the discharge and that standard or prohibition is more stringent than any limitation on the pollutant in this General Permit, this General Permit shall be modified or revoked and reissued to conform to the toxic effluent standard or prohibition and the dischargers so notified.

3. Need to Halt or Reduce Activity Not a Defense

It shall not be a defense for a discharger in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this General Permit.

4. Duty to Mitigate

The discharger shall take all responsible steps to minimize or prevent any discharge in violation of this General Permit, which has a reasonable likelihood of adversely affecting human health or the environment.

5. Proper Operation and Maintenance

The discharger shall at all times properly operate and maintain any facilities and systems of treatment and control (and related appurtenances) which are installed or used by the discharger to achieve compliance with the conditions of this General Permit and with the requirements of Storm Water Pollution Prevention Plans (SWPPP). Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. Proper operation and maintenance may require the operation of backup or auxiliary facilities or similar systems installed by a discharger when necessary to achieve compliance with the conditions of this General Permit.

6. Property Rights

This General Permit does not convey any property rights of any sort or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor does it authorize any infringement of Federal, State, or local laws or regulations.

7. Duty to Provide Information

The discharger shall furnish the RWQCB, State Water Resources Control Board, or USEPA, within a reasonable time, any requested information to determine compliance with this General Permit. The discharger shall also furnish, upon request, copies of records required to be kept by this General Permit.

8. Inspection and Entry

The discharger shall allow the RWQCB, SWRCB, USEPA, and/or, in the case of construction sites which discharge through a municipal separate storm sewer, an authorized representative of the municipal operator of the separate storm sewer system receiving the discharge, upon the presentation of credentials and other documents as may be required by law, to:

- a. Enter upon the discharger's premises at reasonable times where a regulated construction activity is being conducted or where records must be kept under the conditions of this General Permit;
- b. Access and copy at reasonable times any records that must be kept under the conditions of this General Permit;

- c. Inspect at reasonable times the complete construction site, including any off-site staging areas or material storage areas, and the erosion/sediment controls; and
- d. Sample or monitor at reasonable times for the purpose of ensuring General Permit compliance.

9. Signatory Requirements

- a. All Notice of Intents (NOIs), Notice of Terminations (NOTs), SWPPPs, certifications, and reports prepared in accordance with this Order submitted to the SWRCB shall be signed as follows:
 - (1) For a corporation: by a responsible corporate officer. For the purpose of this Section, a responsible corporate officer means: (a) a president, secretary, treasurer, or vice president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or (b) the manager of the construction activity if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;
 - (2) For a partnership or sole proprietorship: by a general partner or the proprietor, respectively; or
 - (3) For a municipality, State, Federal, or other public agency: by either a principal executive officer, ranking elected official, or duly authorized representative. The principal executive officer of a Federal agency includes the chief executive officer of the agency or the senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of USEPA).
- b. All SWPPPs, reports, certifications, or other information required by the General Permit and/or requested by the RWQCB, SWRCB, USEPA, or the local storm water management agency shall be signed by a person described above or by a duly authorized representative. A person is a duly authorized representative if:
 - (1) The authorization is made in writing by a person described above and retained as part of the SWPPP; or

(2) The authorization specifies either an individual or a position having responsibility for the overall operation of the construction activity, such as the position of manager, operator, superintendent, or position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company. (A duly authorized representative may thus be either a named individual or any individual occupying a named position).

c. If an authorization is no longer accurate because a different individual or position has responsibility for the overall operation of the construction activity, a new authorization must be attached to the SWPPP prior to submittal of any reports, information, or certifications to be signed by the authorized representative.

10. Certification

Any person signing documents under Section C, Provision 9 above, shall make the following certification:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, to the best of my knowledge and belief, the information submitted is, true, accurate, and complete.

I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

11. Anticipated Noncompliance

The discharger will give advance notice to the RWQCB and local storm water management agency of any planned changes in the construction activity which may result in noncompliance with General Permit requirements.

12. Penalties for Falsification of Reports

Section 309(c)(4) of the CWA provides that any person who knowingly makes any false material statement, representation, or certification in any record or other document submitted or required to be maintained under this General Permit, including reports of compliance or noncompliance shall upon conviction, be punished by a fine of not more than \$10,000 or by imprisonment for not more than two years or by both.

13. Oil and Hazardous Substance Liability

Nothing in this General Permit shall be construed to preclude the institution of any legal action or relieve the discharger from any responsibilities, liabilities, or penalties to which the discharger is or may be subject to under Section 311 of the CWA.

14. Severability

The provisions of this General Permit are severable; and, if any provision of this General Permit or the application of any provision of this General Permit to any circumstance is held invalid, the application of such provision to other circumstances and the remainder of this General Permit shall not be affected thereby.

15. Reopener Clause

This General Permit may be modified, revoked and reissued, or terminated for cause due to promulgation of amended regulations, receipt of USEPA guidance concerning regulated activities, judicial decision, or in accordance with 40 Code of Federal Regulations (CFR) 122.62, 122.63, 122.64, and 124.5.

16. Penalties for Violations of Permit Conditions

- a. Section 309 of the CWA provides significant penalties for any person who violates a permit condition implementing Sections 301, 302, 306, 307, 308, 318, or 405 of the CWA or any permit condition or limitation implementing any such section in a permit issued under Section 402. Any person who violates any permit condition of this General Permit is subject to a civil penalty not to exceed \$27,500 per calendar day of such violation, as well as any other appropriate sanction provided by Section 309 of the CWA.
- b. The Porter-Cologne Water Quality Control Act also provides for civil and criminal penalties which in some cases are greater than those under the CWA.

17. Availability

A copy of this General Permit shall be maintained at the construction site during construction activity and be available to operating personnel.

18. Transfers

This General Permit is not transferable. A new owner of an ongoing construction activity must submit a NOI in accordance with the requirements of this General Permit to be authorized to discharge under this General Permit. An owner who sells property covered by this General Permit shall inform the new owner of the duty to file a NOI and shall provide the new owner with a copy of this General Permit.

19. Continuation of Expired Permit

This General Permit continues in force and effect until a new General Permit is issued or the SWRCB rescinds this General Permit. Only those dischargers authorized to discharge under the expiring General Permit are covered by the continued General Permit.

SWRCB AND RWQCB CONTACT LIST
STATE WATER RESOURCES CONTROL BOARD

Please see Storm Water Contacts at
<http://www.swrcb.ca.gov/stormwtr/contact.html>

STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 2001- 046

MODIFICATION OF WATER QUALITY ORDER 99-08-DWQ STATE WATER
RESOURCES CONTROL BOARD (SWRCB) NATIONAL POLLUTANT DISCHARGE
ELIMINATION SYSTEM (NPDES) GENERAL PERMIT FOR STORM WATER
DISCHARGES ASSOCIATED WITH CONSTRUCTION ACTIVITY

WHEREAS:

1. The SWRCB adopted a statewide general NPDES permit for storm water discharges associated with construction activity (General Permit) on August 19, 1999.
2. The San Francisco BayKeeper, Santa Monica BayKeeper, San Diego BayKeeper, and Orange Coast Keeper filed a petition for writ of mandate challenging the General Permit in the Superior Court, County of Sacramento.
3. The court directed the SWRCB to modify the provisions of the General Permit to require permittees to implement specific sampling and analytical procedures to determine whether Best Management Practices implemented on a construction site are: (a) preventing further impairment by sediment in storm waters discharged directly into waters listed as impaired for sediment or silt, and (b) preventing other pollutants, that are known or should be known by permittees to occur on construction sites and that are not visually detectable in storm water discharges, from causing or contributing to exceedances of water quality objectives.
4. A public hearing was held on February 7, 2001 to receive comments on the proposed modification language. All comments and testimony have been considered. The Attachment specifies the changes to the monitoring provisions in the General Permit in response to the written comments submitted and the testimony taken at the hearing.
5. On April 4, 2001 an SWRCB Workshop was held and informal comments were heard from the public. The draft modification language was subsequently changed in response to these comments. This current draft is posted on the Internet web page in a strike-out/underline format.

THEREFORE BE IT RESOLVED THAT:

The SWRCB adopts the modified findings and monitoring provisions in the General Permit (Attachment).

CERTIFICATION

The undersigned, Clerk to the Board, does hereby certify that the foregoing is a full, true, and correct copy of a resolution duly and regularly adopted at a meeting of the State Water Resources Control Board held on April 26, 2001.

_____/s/_____
Maureen Marché
Clerk to the Board

MODIFICATIONS TO WATER QUALITY ORDER 99-08-DWQ
STATE WATER RESOURCES CONTROL BOARD (SWRCB)
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
GENERAL PERMIT FOR
STORM WATER DISCHARGES ASSOCIATED WITH
CONSTRUCTION ACTIVITY (GENERAL PERMIT)

MODIFICATIONS TO THE FACT SHEET

The following paragraph is added to BACKGROUND

On August 19, 1999, the State Water Resources Control Board (SWRCB) reissued the General Construction Storm Water Permit (Water Quality Order 99-08-DWQ referred to as "General Permit"). The San Francisco BayKeeper, Santa Monica BayKeeper, San Diego BayKeeper, and Orange Coast Keeper filed a petition for writ of mandate challenging the General Permit in the Superior Court, County of Sacramento. The Court issued a judgment and writ of mandate on September 15, 2000. The Court directed the SWRCB to modify the provisions of the General Permit to require permittees to implement specific sampling and analytical procedures to determine whether Best Management Practices (BMPs) implemented on a construction site are: (1) preventing further impairment by sediment in storm waters discharged directly into waters listed as impaired for sediment or silt, and (2) preventing other pollutants, that are known or should be known by permittees to occur on construction sites and that are not visually detectable in storm water discharges, from causing or contributing to exceedances of water quality objectives. The monitoring provisions in the General Permit have been modified pursuant to the court order.

MODIFICATIONS TO THE PERMIT

Finding 15:

The Monitoring Program and Reporting Requirements are modified in compliance with a judgment in the case of *San Francisco BayKeeper, et al. v. State Water Resources Control Board*. The modifications include sampling and analysis requirements for direct discharges of sediment to waters impaired due to sediment and for pollutants that are not visually detectable in runoff that may cause or contribute to an exceedance of water quality objectives.

SECTION A: STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

1. Objectives

- e. Identify a sampling and analysis strategy and sampling schedule for discharges from construction activity which discharge directly into water bodies listed on Attachment 3. (Clean Water Act Section 303(d) [303(d)] Water Bodies listed for Sedimentation).

- f. For all construction activity, identify a sampling and analysis strategy and sampling schedule for discharges that have been discovered through visual monitoring to be potentially contaminated by pollutants not visually detectable in the runoff.

2. Implementation Schedule

- d. Existing permittees shall revise their SWPPP in accordance with the sampling and analysis modifications prior to August 1, 2001. For ongoing construction activity involving a change of ownership the new owner shall review the existing SWPPP and amend the sampling and analysis strategy, if required, within 45 days. For construction activity commencing after the date of adoption, the SWPPP shall be developed in accordance with the modification language adopted.

5. Source Identification

b. Pollutant Source and BMP Identification

- (7) Show the locations of direct discharge from the construction site into a Section 303(d) list water body. Show the designated sampling locations in the receiving waters, which represent the prevailing conditions of the water bodies upstream of the construction site discharge and immediately downstream from the last point of discharge.
- (8) Show the locations designated for sampling the discharge from areas identified in Section A. 5. b. (2), (3), and (4) and Section A. 5. c. (1) and (2). Samples shall be taken should visual monitoring indicate that there has been a breach, malfunction, leakage, or spill from a BMP which could result in the discharge in storm water of pollutants that would not be visually detectable, or if storm water comes into contact with soil amendments or other exposed materials or contamination and is allowed to be discharged. Describe the sampling procedure, location, and rationale for obtaining the uncontaminated sample of storm water.

SECTION B: MONITORING PROGRAM AND REPORTING REQUIREMENTS

7. Monitoring Program for Sedimentation/Siltation

Dischargers of storm water associated with construction activity that directly enters a water body listed in Attachment 3 shall conduct a sampling and analysis program for the pollutants (sedimentation/siltation or turbidity) causing the impairment. The discharger shall monitor for the applicable parameter. If the water body is listed for sedimentation or siltation, samples should be analyzed for Settleable Solids (ml/l) and Total Suspended Solids (mg/l). Alternatively or in addition, samples may be analyzed for suspended sediment concentration according to ASTM D3977-97. If the water body is listed for turbidity, samples should be analyzed for turbidity (NTU). Discharges that flow through tributaries that are not listed in Attachment 3 or that flow into Municipal Separate Storm Sewer Systems (MS4) are not subject to these sampling and analysis requirements. The sampling and analysis parameters and procedures must be designed to determine whether the BMPs installed and maintained prevent discharges of sediment from contributing to

impairment in receiving waters.

Samples shall be collected during the first two hours of discharge from rain events which result in a direct discharge to any water body listed in Attachment 3. Samples shall be collected during daylight hours (sunrise to sunset). Dischargers need not collect more than four (4) samples per month. All samples shall be taken in the receiving waters and shall be representative of the prevailing conditions of the water bodies. Samples shall be collected from safely accessible locations upstream of the construction site discharge and immediately downstream from the last point of discharge.

For laboratory analysis, all sampling, sample preservation, and analyses must be conducted according to test procedures under 40 CFR Part 136. Field samples shall be collected and analyzed according to the specifications of the manufacturer of the sampling devices employed. Portable meters shall be calibrated according to manufacturer's specification. All field and/or laboratory analytical data shall be kept in the SWPPP document, which is to remain at the construction site at all times until a Notice of Termination has been submitted and approved.

8. Monitoring Program for Pollutants Not Visually Detectable in Storm Water

A sampling and analysis program shall be developed and conducted for pollutants which are not visually detectable in storm water discharges, which are or should be known to occur on the construction site, and which could cause or contribute to an exceedance of water quality objectives in the receiving water. Pollutants that should be considered for inclusion in this sampling and analysis program are those identified in Sections A.5.b. and A.5.c.

Construction materials and compounds that are not stored in water-tight containers under a water-tight roof or inside a building are examples of materials for which the discharger may have to implement sampling and analysis procedures. The goal of the sampling and analysis is to determine whether the BMPs employed and maintained on site are effective in preventing the potential pollutants from coming in contact with storm water and causing or contributing to an exceedance of water quality objectives in the receiving waters. Examples of construction sites that may require sampling and analysis include: sites that are known to have contaminants spilled or spread on the ground; sites where construction practices include the application of soil amendments, such as gypsum, which can increase the pH of the runoff; or sites having uncovered stockpiles of material exposed to storm water. Visual observations before, during, and after storm events may trigger the requirement to collect samples. Any breach, malfunction, leakage, or spill observed which could result in the discharge of pollutants to surface waters that would not be visually detectable in storm water shall trigger the collection of a sample of discharge. Samples shall be collected at all discharge locations which drain the areas identified by the visual observations and which can be safely accessed. For sites where sampling and analysis is required, personnel trained in water quality sampling procedures shall collect storm water samples. A sufficiently large sample of storm water that has not come in contact with the disturbed soil or the materials stored or used on-site (uncontaminated sample) shall be collected for comparison with the discharge sample. Samples shall be collected during the first two hours of discharge from rain events that occur during daylight hours and which generate runoff.

The uncontaminated sample shall be compared to the samples of discharge using field analysis or through laboratory analysis. Analyses may include, but are not limited to, indicator parameters such as: pH, specific conductance, dissolved oxygen, conductivity, salinity, and TDS.

For laboratory analysis, all sampling, sample preservation, and analyses must be conducted according to test procedures under 40 CFR Part 136. Field discharge samples shall be collected and analyzed according to the specifications of the manufacturer of the sampling devices employed. Portable meters shall be calibrated according to manufacturer's specification. All field and/or analytical data shall be kept in the SWPPP document, which is to remain at the construction site at all times until a Notice of Termination has been submitted and approved.



Anton H. Hickox
Secretary for
Environmental
Protection

State Water Resources Control Board

Division of Water Quality

1001 I Street • Sacramento, California 95814 • (916) 341-5537
Mailing Address: P.O. Box 1977 • Sacramento, California • 95812-1977
FAX (916) 341-5543 • Internet Address: <http://www.swrcb.ca.gov>



Gray Davis
Governor

To: Storm Water Permit Holder

RE: NOTICE OF TERMINATION OF COVERAGE UNDER THE GENERAL
CONSTRUCTION STORM WATER PERMIT (GENERAL PERMIT)

In order for us to terminate your coverage under the General Permit, please complete and submit the enclosed Notice of Termination (NOT) your local Regional Water Quality Control Board (RWQCB). Refer to the last page of the NOT packet for RWQCB locations.

Please note that you are subject to the annual fee until you file a NOT and the RWQCB approves your NOT.

Should you have any questions regarding this matter, please contact your local RWQCB at the number listed on the back page of the NOT package, or the Storm Water Unit at (916) 341-5537.

Sincerely,

Storm Water Unit
Division of Water Quality

Enclosure

NOTICE OF TERMINATION

OF COVERAGE UNDER THE NPDES GENERAL PERMIT NO. CAS000002
FOR DISCHARGES OF STORM WATER
ASSOCIATED WITH CONSTRUCTION ACTIVITY

Submission of this Notice of Termination constitutes notice that the owner (and his/her agent) of the site identified on this form is no longer authorized to discharge storm water associated with construction activity by NPDES General Permit No. CAS000002.

I. WDID NO. _____

II. OWNER

COMPANY NAME _____ CONTACT PERSON _____
STREET ADDRESS _____ TITLE _____
CITY _____ STATE _____ ZIP _____ PHONE _____

III. CONSTRUCTION SITE INFORMATION

A. DEVELOPER NAME _____ CONTACT PERSON _____
STREET ADDRESS _____ TITLE _____
CITY _____ CA _____ ZIP _____ PHONE _____
B. SITE ADDRESS _____ COUNTY _____
CITY _____ CA _____ ZIP _____ PHONE _____

IV. BASIS OF TERMINATION

_____ 1. The construction project is complete and the following conditions have been met.

- All elements of the Storm Water Pollution Prevention Plan have been completed.
- Construction materials and waste have been disposed of properly.
- The site is in compliance with all local storm water management requirements.
- A post-construction storm water operation and management plan is in place.

Date of project completion ____/____/____

_____ 2. Construction activities have been suspended, either temporarily _____ or indefinitely _____ and the following conditions have been met.

- All elements of the Storm Water Pollution Prevention Plan have been completed.
- Construction materials and waste have been disposed of properly.
- All denuded areas and other areas of potential erosion are stabilized.
- An operation and maintenance plan for erosion and sediment control is in place.
- The site is in compliance with all local storm water management requirements.

Date of suspension ____/____/____ Expected start up date ____/____/____

_____ 3. Site can not discharge storm water to waters of the United States (check one).

_____ All storm water is retained on site.

_____ All storm water is discharged to evaporation or percolation ponds offsite.

- _____ 4. Discharge of storm water from the site is now subject to another NPDES general permit or an individual NPDES permit.

NPDES Permit No. _____ Date coverage began ____/____/____

- _____ 5. There is a new owner of the identified site. Date of owner transfer ____/____/____

Was the new owner notified of the General Permit requirements? YES _____ NO _____

NEW OWNER INFORMATION

COMPANY NAME _____ CONTACT PERSON _____

STREET ADDRESS _____ TITLE _____

CITY _____ STATE _____ ZIP _____ PHONE _____

V. EXPLANATION OF BASIS OF TERMINATION (Attach site photographs - see instructions).

VI. CERTIFICATION:

I certify under penalty of law that all storm water discharges associated with construction activity from the identified site that are authorized by NPDES General Permit No. CAS000002 have been eliminated or that I am no longer the owner of the site. I understand that by submitting this Notice of Termination, I am no longer authorized to discharge storm water associated with construction activity under the general permit, and that discharging pollutants in storm water associated with construction activity to waters of the United States is unlawful under the Clean Water Act where the discharge is not authorized by a NPDES permit. I also understand that the submittal of this Notice of Termination does not release an owner from liability for any violations of the general permit or the Clean Water Act.

PRINTED NAME _____ TITLE _____

SIGNATURE: _____ DATE ____/____/____

REGIONAL WATER BOARD USE ONLY

This Notice of Termination has been reviewed, and I recommend termination of coverage under the subject NPDES general permit.

Printed Name _____ Region No. _____

Signature _____ Date ____/____/____

**INSTRUCTIONS FOR COMPLETING
NOTICE OF TERMINATION
FOR CONSTRUCTION ACTIVITY**

Who May File

Dischargers who are presently covered under NPDES General Permit No. CAS000002 for discharge of storm water associated with construction activity may submit a Notice of Termination when they meet one of the following criteria.

1. The construction project has been completed and the following conditions have been met: all elements of the Stormwater Pollution Prevention Plan have been completed; construction materials and equipment maintenance waste have been disposed of properly; the site is in compliance with all local storm water management requirements including erosion/sediment control requirements and the appropriate use permits have been obtained; and a post-construction storm water operation and management plan is in place.
2. Construction activities have been suspended, either temporarily or indefinitely and the following conditions have been: all elements of the Stormwater Pollution Prevention Plan have been completed; construction materials and equipment maintenance waste have been disposed of properly; all denuded areas and other areas of potential erosion are stabilized; an operation and maintenance plan for erosion and sediment control is in place; and the site is in compliance with all local storm water management requirements including erosion/sediment control requirements.
The date construction activities were suspended, and the expected date construction activities will start up again should be provided.
3. Construction site can not discharge storm water to waters of the United States. Please indicate if all storm water is retained on site or if storm water is collected offsite.
4. Discharge of construction storm water from the site is now subject to another NPDES general permit or an individual NPDES permit. The general permit or individual permit NPDES number and date coverage began should be provided.
5. There is a new owner of the identified site. If ownership or operation of the facility has been transferred then the previous owner must submit a Notice of Termination and the new owner must submit a Notice of Intent for coverage under the general permit. The date of transfer and information on the new owner should be provided. Note that the previous owner may be liable for discharge from the site until the new owner files a Notice of Intent for coverage under the general permit.

Where to File

The Notice of Termination should be submitted to the Executive Officer of the Regional Water Board responsible for the area in which the facility is located. See attached. If the Executive Officer, or his designated staff, agrees with the basis of termination, the Notice of Termination will be transmitted to the State Water Board for processing. If the Executive Officer, or his designated staff, does not agree with the basis of termination, the Notice of Termination will be returned. The Regional Water Board may also inspect your site prior to accepting the basis of termination.

LINE-BY-LINE INSTRUCTIONS

All necessary information must be provided on the form. Type or print in the appropriate areas only. Submit additional information, if necessary, on a separate sheet of paper.

SECTION I--WDID NO.

The WDID No. is a number assigned to each discharger covered under the General Permit. If you do not know your WDID No., please call the State Water Board or Regional Water Board and request it prior to submittal of the Notice of Termination.

SECTION II--OWNER

Enter the owner of the construction site's official or legal name (This should correspond with the name on the Notice of Intent submitted for the site), address of the owner, contact person, and contact person's title and telephone number.

SECTION III--CONSTRUCTION SITE INFORMATION

In Part A, enter the name of the developer (or general contractor), address, contact person, and contact person's title and telephone number. The contact person should be the construction site manager completely familiar with the construction site and charged with compliance and oversight of the general permit. This information should correspond with information on the Notice of Intent submitted for the site.

In Part B, enter the address, county, and telephone number (if any) of the construction site. Construction sites that do not have a street address must attach a legal description of the site.

SECTION IV--BASIS OF TERMINATION

Check the category which best defines the basis of your termination request. See the discussion of the criteria in the Who May File section of these instructions. Provide dates and other information requested. Use the space under Explanation of Basis of Termination heading.

SECTION V--EXPLANATION OF BASIS OF TERMINATION

Please explain the basis or reasons why you believe your construction site is not required to comply with the General Permit. To support your explanation, provide a site map and photograph of your site.

SECTION VI--CERTIFICATION

This section must be completed by the owner of the site.

The Notice of Termination must be signed by:

For a Corporation: a responsible corporate officer

For a Partnership or Sole Proprietorship: a general partner or the proprietor, respectively.

For a Municipality, State, or other Non-Federal Public Agency: either a principal executive officer or ranking elected official.

For a Federal Agency: either the chief or senior executive officer of the agency.

APPENDIX C

SAMPLING AND ANALYSIS PLAN

APPENDIX C
FINAL SAMPLING AND ANALYSIS PLAN
(FIELD SAMPLING PLAN/QUALITY ASSURANCE PROJECT PLAN)

FOR
SITE 27
FORMER NAVAL AIR STATION MOFFETT FIELD,
MOFFETT FIELD, CALIFORNIA

ENVIRONMENTAL MULTIPLE AWARD CONTRACT
Contract Number N68711-04-D-1105
Contract Task Order 0002

January 13, 2006

Prepared for



Base Realignment and Closure
Program Management Office West
Mr. Scott Gromko, Remedial Project Manager
1455 Frazee Road, Suite 900
San Diego, CA 92108

Prepared by



317 East Main Street
Ventura, California 93001



TETRA TECH EC, INC.

1940 East Deere Avenue, Suite 200
Santa Ana, California 92705

**FINAL SAMPLING AND ANALYSIS PLAN
(FIELD SAMPLING PLAN/QUALITY ASSURANCE PROJECT PLAN)**

FOR

**REMEDIAL DESIGN PLAN FOR SITE 27
FORMER NAVAL AIR STATION MOFFETT FIELD
MOFFETT FIELD, CALIFORNIA**

**ENVIRONMENTAL MULTIPLE AWARD CONTRACT (EMAC)
Contract Number N68711-04-D-1105
Contract Task Order 0002**

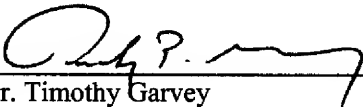
January 13, 2006

Prepared for:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

TN&A Deputy Program Manager:


Mr. Timothy Garvey

Date: January 9, 2006

TN&A QA Program Manager:


Mr. John Fleissner

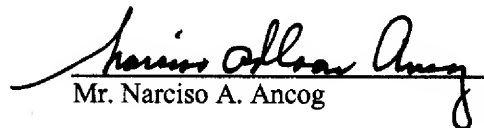
Date: January 9, 2006

TN&A Project Chemist:


Ms. Ewelina Mutkowska

Date: January 9, 2006

Navy QA Officer:


Mr. Narciso A. Ancog

Date: 1/17/2006

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Notes

BRAC – Base Realignment and Closure
EFA – Engineering Field Activity
NAVFAC SW – Navel Facilities Engineering Command, Southwest
QA – quality assurance
ROICC – Resident Officer In Charge of Construction
TN&A – TN & Associates, Inc.
TtEC – Tetra Tech EC, Inc.

ELEMENTS OF EPA QA/R-5 IN RELATION TO THIS SAP

U.S. EPA QA/R-5 QAPP ELEMENT ^(a)		CORRESPONDING TN&A SAP SECTION
A1	Title and Approval Sheet	Title and Approval Sheet
A2	Table of Contents	Table of Contents
A3	Distribution List	Distribution List
A4	Project/Task Organization	1.4 Project Organization
A5	Problem Definition/Background	1.1 Problem Definition and Background
A6	Project/Task Description	1.2 Project Description
A7	Quality Objectives and Criteria	1.3 Quality Objectives and Criteria
A8	Special Training/Certification	1.5 Special Training and Certification
A9	Documents and Records	1.6 Documents and Records
B1	Sampling Process Design	2.1 Sampling Process Design
B2	Sampling Methods	2.2 Sampling Collection Methodology
B3	Sample Handling and Custody	2.3 Sample Handling and Custody
B4	Analytical Methods	2.4 Analytical Methods
B5	Quality Control	2.5 Quality Control
B6	Instrument/Equipment Testing, Inspection, and Maintenance	2.6 Equipment Testing, Inspection, and Maintenance
B7	Instrument/Equipment Calibration and Frequency	2.7 Instrument Calibration and Frequency
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C1	Assessment and Response Actions	3.1 Assessment and Response Actions
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D1	Data Review, Verification, and Validation	4.1 Data Review, Verification, and Validation
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Notes

^a EPA. 2001. *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, QAMS*. March.

EPA U.S. Environmental Protection Agency
 QA quality assurance
 QAPP Quality Assurance Project Plan
 SAP Sampling and Analysis Plan
 TN&A T N & Associates, Inc.

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ACRONYMS AND ABBREVIATIONS

%R	percent recovery
µg/kg	micrograms per kilogram
°C	degrees Celsius
°F	degrees Fahrenheit
A2LA	American Association for Laboratory Accreditation
bgs	below ground surface
BOD	biochemical oxygen demand
BRAC	Base Realignment and Closure
CARB	California Air Resources Board
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	chain-of-custody
COD	chemical oxygen demand
COPEC	chemical of potential ecological concern
CPR	Cardiopulmonary Resuscitation
CTO	contract task order
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DHS	Department of Health Services
DoD	Department of Defense
DQA	data quality assessment
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
EMAC	Environmental Multiple Award Contract
EPA	U.S. Environmental Protection Agency
EWI	Environmental Work Instruction
FTL	field team leader
GC/MS	gas chromatograph/mass spectrometer

ACRONYMS AND ABBREVIATIONS

(Continued)

GPC	gel permeation cleanup
GPS	global positioning system
HCl	hydrochloric acid
HPLC	high-performance liquid chromatography
ICP	inductively coupled plasma
IDL	instrument detection limit
IDW	investigation-derived waste
JMM	James M. Montgomery, Consulting Engineers, Inc.
L	liter
LCS	laboratory control spike
LIMS	laboratory information management system
LTA	lighter-than-air
MDL	method detection limit
mg/kg	milligrams per kilogram
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
msl	mean sea level
MSR	monthly status report
N/A	not applicable
NAS	Naval Air Station
NASA	National Aeronautics and Space Administration
NAVFAC SW	Naval Facilities Engineering Command, Southwest
NEDD	Naval Electronic Data Deliverable
NFECSW	Southwest Division, Naval Facilities Engineering Command
NFESC	Naval Facilities Engineering Service Center
NPDES	National Pollutant Discharge Elimination System
NTU	nephelometric turbidity unit
OSHA	Occupational Safety and Health Administration
PARCC	precision, accuracy, representativeness, completeness, and comparability

ACRONYMS AND ABBREVIATIONS

(Continued)

PCB	polychlorinated biphenyl
PMO	Program Management Office
POTW	publicly owned treatment works
PPE	personal protective equipment
PRC	PRC Environmental Management, Inc.
PRG	Preliminary Remediation Goal
PRRL	project-required reporting limit
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QCSR	Quality Control Summary Report
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RPD	relative percent difference
RPM	Remedial Project Manager
RTC	Response to Comments
SAP	Sampling and Analysis Plan
SDG	sample delivery group
SIM	Selective Ion Monitoring
SOP	standard operating procedure
SOW	statement of work
STLC	Soluble Threshold Limit Concentration
SVOA	semivolatile organic analysis
SVOC	semivolatile organic compound
TBD	to be determined
TCLP	Toxicity Characteristic Leaching Procedure
TIC	tentatively identified compounds
TN&A	T N & Associates, Inc.
TOC	total organic carbon

ACRONYMS AND ABBREVIATIONS

(Continued)

TPH-extractable	total extractable petroleum hydrocarbons
TPH-purgeable	total purgeable petroleum hydrocarbons
TSA	technical systems audit
TSS	total suspended solids
TtEC	Tetra Tech EC, Inc.
TtEMI	Tetra Tech EM, Inc.
USCS	Unified Soil Classification Service
USFWS	United States Fish and Wildlife Service
VOA	volatile organic analysis
VOC	volatile organic compound
WB	California Water Board

1.0 PROJECT DESCRIPTION AND MANAGEMENT

This Sampling and Analysis Plan (SAP) has been prepared for the Navy and the Base Realignment and Closure (BRAC) Program Management Office (PMO) West by the T N & Associates, Inc. (TN&A)/Tetra Tech EC, Inc. (TtEC) team on behalf of the Naval Facilities Engineering Command, Southwest (NAVFAC SW) Environmental Multiple Action Contract (EMAC) No. N68711-04-D-1105. The purpose of the SAP is to provide guidance on sampling, analysis, and quality assurance (QA) for remedial design field activities at Site 27 located at former Naval Air Station (NAS) Moffett Field (Moffett) in Mountain View, California.

The SAP will be used as a reference document by the contractor selected to implement the remedial design. Included in this SAP are field sampling procedures, QA/quality control (QC) requirements, and data gathering methods that will be used during the pre-design activities. Data quality objectives (DQOs) are also provided in this document. The QA elements of this SAP were prepared in accordance with the [U.S. Environmental Protection Agency] *EPA Requirements for Quality Assurance Project Plans* [QAPP], *EPA QA/R-5*, *QAMS* (EPA, 2001) to ensure that all data collected are precise, accurate, representative, complete, and comparable to meet their intended use. When circumstances arise that impact the original project DQOs, such as a significant change in work scope, this SAP will be revised or amended. The modification process will be based on EPA guidelines, direction from the Navy, and will be in conjunction with *Environmental Work Instruction (EWI) #2, 3EN2.2, Review, Approval, Revision, and Amendment of Sampling and Analysis Plans (SAPs)* [Southwest Division, Naval Facilities Engineering Command (NFECSW), 2001a].

The EPA QA/R-5 table follows the approval page at the beginning of this SAP. The table demonstrates how this SAP addresses all QAPP elements currently required by the EPA QA/R-5 guidance document (EPA, 2001).

In this document, tables and figures are located at the end of the text. [Attachment A](#) contains Method Precision and Accuracy Goals, and [Attachment B](#) lists Project-required Reporting Limits.

1.1 PROBLEM DEFINITION AND BACKGROUND

This section describes the following:

- Purpose of the Investigation ([Section 1.1.1](#))
- Facility Background ([Section 1.1.2](#))
- Project Site Background ([Section 1.1.3](#))
- Site Physical Setting ([Section 1.1.4](#))

- Principal Decision Makers ([Section 1.1.5](#))
- Technical or Regulatory Standards ([Section 1.1.6](#))

1.1.1 Purpose of the Investigation

The TN&A/TtEC team has been contracted to prepare a Remedial Design Plan for Site 27 based on the selected alternative identified in the *Final Record of Decision* [ROD], *Site 27 - Northern Channel* (BRAC PMO West, 2005). The selected alternative is the excavation of the contaminated sediment in the Northern Channel and associated ditches and the contaminated soil in the berm above the Remedial Action Objectives (RAOs) (for RAOs refer to [Section 1.1.6](#)) for the chemicals of potential ecological concern (COPECs). As part of this action, the Building 191 lift station debris pile would also be removed. The channel, ditches, berms and debris pile are impacted with polychlorinated biphenyls (PCBs), pesticides, and metals. Contaminated sediment, soil, and debris are to be disposed off site in Class I and Class II landfills.

As part of the Remedial Design Plan, this SAP has been prepared to provide guidance for and identify the sampling activities during the remedial action/construction and is to be implemented by the selected construction contractor.

The objectives of this SAP are to: 1) provide guidance for the field sampling activities during the implementation of the remedial design at Site 27; 2) describe and establish consistent field sampling procedures; 3) establish data gathering, handling, and documentation methods; and 4) define QA/QC measures to ensure consistency and confidence in the data obtained.

The primary objectives are to collect confirmation samples for chemical testing necessary during remedial activities to ensure that all of the contaminated sediment and soil have been removed from the excavated areas, in situ sampling is performed for waste characterization and segregation purposes, and verification that imported backfill material does not exceed RAOs. Details regarding the remediation approach, including segregation procedures for excavated sediment and soil, are provided in the Remedial Design Plan.

Specific objectives are the following:

- Prior to commencement of field activities, collect a mixture of sediment and water from the Northern Channel for bench-scale testing to ensure that the water treatment system would be able to handle the dewatering and discharge requirements.
- Collect in situ sediment samples from within the Northern Channel, Marriage Road Ditch, and North Patrol Road Ditch for chemical testing for waste characterization purposes.
- Collect in situ soil samples of the north and south slopes of the western portion (first 800 linear feet) of the Northern Channel and the Lockheed berm near the eastern end of the Northern Channel for chemical testing for waste characterization purposes.

- Collect samples from the Building 191 lift station debris after it is stockpiled for chemical testing for waste characterization purposes.
- Perform sampling of the excavated areas [Northern Channel, Marriage Road Ditch, North Patrol Road Ditch, north and south slopes of western portion (first 800 linear feet) of the Northern Channel, the Lockheed berm near the eastern end of the Northern Channel, and the former location of the debris pile] for confirmation purposes to establish that all sediment and soil with concentrations above RAOs have been removed.
- Collect water samples from tanks collecting water runoff from sediment drying pads for chemical testing for waste characterization or discharge purposes.
- Collect and analyze import material samples.

Table C.1-1 provides the schedule for completion of this SAP and an approximate time frame for the implementation. A detailed sampling implementation schedule will be determined after project award.

1.1.2 Facility Background

Moffett is located near the southern end of San Francisco Bay, approximately 35 miles south of San Francisco and 10 miles north of San Jose, California (Figure C.1-1). The facility encompasses about 2,200 acres in Santa Clara County, California.

Moffett was originally commissioned as NAS Sunnyvale in 1933 to support the west coast dirigibles of the lighter-than-air (LTA) program. The Navy operated the facility as NAS Sunnyvale from 1933 to 1935 and again from 1942 to 1994. In 1935, NAS Sunnyvale was transferred to the U.S. Army Air Corps, which used the base for training purposes. In 1939, a permit was granted to Ames Aeronautical Laboratory to use a portion of the base. NAS Sunnyvale returned to Navy control in 1942 and was named NAS Moffett Field. Initially supporting the west coast dirigibles of the LTA program, the facility later was used in a variety of aviation-related capacities, which included transport, training, and anti-submarine patrol activities.

NAS Moffett Field was closed as an active military base and the majority of the property was transferred to National Aeronautics and Space Administration (NASA) on July 1, 1994, under the BRAC program. The facility was renamed Moffett Federal Airfield. The military housing on the base was transferred to the U.S. Air Force and subsequently to the U.S. Army.

1.1.3 Project Site Background

This SAP pertains specifically to Site 27 (Figure C.1-2), which includes the Northern Channel, drainage ditches, and associated features located in the northeastern part of Moffett. These include:

- Marriage Road Ditch

- Patrol Road Ditch
- North Patrol Road Ditch
- Berms along the Northern Channel
- A debris pile located near the Building 191 lift station

The selected alternative in the ROD (BRAC PMO West, 2005) provides for excavation and disposal of sediment and soil from the Northern Channel, the North Patrol Road Ditch, the majority of the Marriage Road Ditch, the western portion (first 800 linear feet) of the north and south slopes of the Northern Channel, the Lockheed berm near the eastern end of the Northern Channel, as well as the debris pile. Since there is no action required for the Patrol Road Ditch or the north and south slopes of the Northern Channel east of the first 800 linear feet, they will not be discussed further.

The channel, ditches, berms and debris pile are impacted with PCBs, pesticides, and metals. The probable source of contamination for Site 27 is historical surface water runoff. PCB contamination may have originally been introduced into the environment by releases from transformers using oil that contained PCBs. Historically, the Site 27 has received stormwater runoff from Moffett and NASA Ames Research Center. The portions of the Northern Channel owned by Lockheed Martin Space Systems Company (Lockheed) and Cargill Salt (Cargill) extend eastward approximately 5,500 feet beyond Moffett's boundary and are also addressed in this SAP. The areas that make up Site 27 that are impacted by the remedial design are described below.

Northern Channel - Approximately 10,000 feet long and typically 40 to 50 feet wide, the Northern Channel continuously contains surface water. The channel receives runoff from many of the drainage ditches at Moffett, as well as freshwater input from Building 191 outflow and saltwater input from groundwater recharge and the Cargill ponds. Water in the channel flows east approximately 1 mile beyond the eastern Moffett boundary and gravity feeds through a pipe to the terminus of the Lockheed Channel, where it is pumped into Moffett Channel, flows to Guadalupe Slough, and eventually reaches San Francisco Bay. The channel provides brackish surface water habitat of moderate value to wildlife. The bank slopes are partially eroded and support a moderate amount of shrubs. Wildlife surveys have detected the western pond turtle, several species of plants, and a wide variety of shore birds and waterfowl in the area.

Marriage Road Ditch - Located east of the runways, Marriage Road Ditch is approximately 2,300 feet long and drains into the North Patrol Road Ditch. Marriage Road Ditch previously received runoff year-round from the East-Side Aquifer Treatment System (approximately 30 gallons per minute), until July 1, 2003, when the treatment system was shut down. Marriage Road Ditch receives runoff from the golf course, the runways, the east apron area, and the storm drains in the vicinity of Hangars 2 and 3. Some sections of the ditch have a concrete-lined

bottom. The ditch provides habitat for insects, worms, snails, and the western pond turtle. Several species of plants grow in and along the sides of the ditch.

North Patrol Road Ditch - This ditch runs 4,300 feet along the North Patrol Road, parallel and south of the Northern Channel. The western portion of the ditch is lined with concrete and generally contains water year-round. It carries surface water runoff from the Marriage Road Ditch, Patrol Road Ditch, and the golf course west to the Building 191 lift station, where it is pumped into the Northern Channel. The ditch has defined banks made of fill material and emergent vegetation, but makes poor wetland habitat. Species observed here include ducks, doves, and squirrels. Burrowing owls use the habitat provided by the berm that separates the ditch from the Northern Channel.

Debris Pile - The debris pile is located north of the Building 191 lift station at the west end of the Northern Channel, between the north bank of the channel and south bank of the United States Fish and Wildlife Service (USFWS) ponds, formerly Cargill evaporation ponds. The pile consists of dredged sediments from the Northern Channel, construction debris, and riprap such as broken concrete, asphalt, and other debris left from the 1950s that may have been used to stabilize and prevent erosion of the berm on the west end of the Northern Channel.

1.1.4 Site Physical Setting

This section describes the physical characteristics of Moffett, including topography, climate, and geology.

1.1.4.1 Topography and Climate

Surface topography at Moffett is relatively flat. The surface elevation of Moffett ranges from 2 feet below to 36 feet above mean sea level (msl). A considerable portion of Moffett is situated on previously submerged land or marshlands that have been filled to their existing elevations with backfill material. The only natural surface waters are the wetlands located in the northern portion of Moffett. Nearby surface drainage includes Stevens Creek to the west and Coyote Creek and Guadalupe Slough to the east of Moffett (Foster Wheeler Environmental Corporation, 2002).

The climate at Moffett typically consists of dry summers and cool winters. During the summer, night and morning high fog impact the area. The average temperature is 58 degrees Fahrenheit (°F), with an average high of 65 °F in September and a mean low of 45 °F in January. In June and September, a maximum temperature of 100 °F and in December and January a minimum temperature of 22 °F have been observed.

The average annual rainfall is 14.1 inches with a maximum monthly average in January of 2.8 inches. The driest months, May through September, have less than 0.5 inch per month (National Ocean and Atmospheric Administration, 2005). The average annual wind velocity is 7 miles per

hour with moderate winds during the day from the north and southwest and from the west during the evening.

1.1.4.2 Geology

Moffett is located at the northern end of the Santa Clara Valley Basin, approximately 1 mile south of San Francisco Bay. Regionally, the Santa Clara Valley contains as much as 1,500 feet of interbedded alluvial, fluvial, and estuarine deposits (Iwamura, 1980). Locally, these sediments consist of varying combinations of clay, silt, sand, and gravel that represent the interfingering of estuarine and alluvial depositional environments during the late Pleistocene and Holocene epochs. The interfingering of fluvial and estuarine sediments in southern San Francisco Bay is related to worldwide fluctuations in sea level during glacial and interglacial episodes of the late Quaternary period [PRC Environmental Management, Inc. (PRC) and James M. Montgomery, Consulting Engineers, Inc. (JMM), 1992]. The fluvial sediments were derived from the Santa Cruz highlands west of the basin and deposited on an alluvial plain bounded by alluvial fan deposits to the west and baylands to the northeast (Iwamura, 1980). These sediments were likely deposited during the Holocene period when the worldwide sea level was rising toward its present elevation.

Surface geologic maps indicate that alluvial fan deposits extend toward the Santa Clara Valley Basin approximately to U.S. Highway 101, which is the southern boundary of Moffett (TtEMI, 2003). Branching river and floodplain deposits are found in the shallow subsurface at Moffett. Estuarine deposits are found at the northernmost end of Moffett.

1.1.4.3 Hydrogeology

The shallow aquifer system at Moffett consists of the upper and lower A aquifer zones, B aquifer and A/B aquitard, and C aquifer and B/C aquitard. Deep aquifers underlie the C aquifer. The A aquifer consists of sands and gravels and is located between the depths of approximately 5 and 65 feet below ground surface (bgs). The A aquifer zone is further divided into the upper and lower A aquifer zone by a discontinuous, low permeability horizontal layer (aquitard), which is found between 25 and 30 feet bgs. Groundwater flow in the A aquifer is toward the north with a horizontal gradient of 0.004 to 0.005.

The B aquifer extends from approximately 60 to 120 feet bgs. Interbedded fine- to medium-grained sands and clayey sands characterize permeable deposits in the B aquifer along with silts and clays. Groundwater flow in the B aquifer zone is generally to the north with a horizontal gradient of 0.004 to 0.005.

The A/B aquitard, a continuous clay layer of late Pleistocene age between 45 and 65 feet below msl, has been observed in borings across Moffett. An even deeper (100 to 160 feet below msl) clay layer (B/C aquitard) corresponds to Sangamon-age interglacial deposits (PRC and JMM, 1992). Beneath this aquitard are undifferentiated alluvial gravels, sands, silts, and clays that

make up the mid- to early Pleistocene-age deposits and the Pliocene/Pleistocene-age Santa Clara Formation.

The C aquifer is confined and extends from 155 to greater than 500 feet bgs. This depth correlates with the upper Illinoian alluvium in the vicinity of Moffett (PRC and JMM, 1992). The Illinoian alluvium was deposited during lower sea levels associated with glacial periods. Silt and clay predominate in the aquifer; however, 3 to 13 feet of discontinuous sand and gravel intervals are present (International Technology Corporation, 1993). The groundwater flow direction for the C aquifer zone is northeast with a horizontal hydraulic gradient of approximately 0.0005 (PRC and JMM, 1992).

Deep aquifers underlie the C aquifer at a depth greater than 240 feet bgs. These aquifers are composed of sand and gravel interbedded with silt and clay layers.

1.1.5 Principal Decision Makers

The Navy is the lead agency responsible for the remedial design of the Northern Channel. The California Water Board (WB), San Francisco Bay Region and EPA provide regulatory oversight.

Additional interested parties, based on their proximity and/or use of the Northern Channel and the associated berms, include the USFWS and the City of Sunnyvale. In 2003, USFWS purchased the saltwater evaporation ponds adjacent to Site 27 from Cargill. The City of Sunnyvale owns ponds and a publicly owned treatment works (POTW) facility located near the eastern end of the Northern Channel and also leases a portion of the berms for hiking and biking trails.

1.1.6 Technical or Regulatory Standards

EPA analytical methods [*Test Methods for Evaluation Solid Waste, Physical Chemical Methods, SW-846* and final updates (EPA, 1986)] provide technical standards for chemical testing. Chemical testing associated with the remedial activities for Site 27 will be conducted in accordance with EPA methods and the *Quality Systems Manual for Environmental Laboratories* [Department of Defense (DoD, 2005)]. Specific regulatory action levels or cleanup goals for the COPECs were established in the ROD (BRAC PMO West, 2005). The overall cleanup goal of this response action is to reduce the concentrations total PCBs, total dichlorodiphenyltrichloroethane (DDT), chlordane, cadmium, lead, mercury, selenium, silver, and zinc [which will be known from here on as the COPECs] in shallow sediments to levels that are protective of sensitive ecological receptors. These levels will also be protective of human health. The RAOs for the sediments are as follows:

- Total PCBs: 350 micrograms per kilogram ($\mu\text{g/kg}$)
- Total DDT: 64.8 $\mu\text{g/kg}$

- Total chlordane: 931 µg/kg
- Cadmium: 184 milligrams per kilogram (mg/kg)
- Lead: 173 mg/kg
- Mercury: 1.52 mg/kg
- Selenium: 0.926 mg/kg
- Silver: 13.7 mg/kg
- Zinc: 720 mg/kg

Also, the cleanup goals for PCBs and other COPECs in the soil along the channel were established and base on the EPA Region 9 Preliminary Remediation Goals (PRGs) for residential use (EPA, 2004a). The RAOs for the soil are as follows:

- Total PCBs: 0.22 mg/kg
- Dichlorodiphenyldichloroethane (DDD): 2.4 mg/kg
- Dichlorodiphenyldichloroethene (DDE): 1.7 mg/kg
- DDT: 1.7 mg/kg
- Total chlordane: 1.6 mg/kg
- Cadmium: 37 mg/kg
- Lead: 150 mg/kg
- Mercury: 23 mg/kg
- Selenium: 390 mg/kg
- Silver: 390 mg/kg
- Zinc: 23,000 mg/kg

Project-required reporting limits (PRRLs) for the above analytical parameters proposed for the soil/sediment samples are compared to the RAOs to assure that PRRLs are sufficiently low to meet this project's DQOs (refer to [Table C.1-2](#)). PRRLs are listed in [Attachment B](#).

1.2 PROJECT DESCRIPTION

The objectives of the field activities at Site 27 are as follows:

- Remove contaminated sediment from within the Northern Channel, Marriage Road Ditch, and North Patrol Road Ditch.
- Remove contaminated soil from the western portion (first 800 linear feet) of the north and south slopes of the Northern Channel and the Lockheed berm near the eastern end of the Northern Channel.
- Remove the debris pile.

- Sufficiently dry out the saturated sediments to meet disposal facility requirements.
- Dispose of all contaminated waste streams off site and discharge treated water from the dewatering system back into the Northern Channel.

Although the ROD (BRAC PMO West, 2005) only recommends removing the most of the Marriage Road Ditch down to the clay layer, per the Remedial Design Plan, all of Marriage Road Ditch will be removed for ease of construction and final grading of the ditch. In order to meet these objectives, the major activities are as follows:

- General project oversight
- Mobilization/Demobilization
- Stockpiling of the debris pile and waste characterization sampling
- In situ waste characterization of Northern Channel, Marriage Road Ditch and North Patrol Road Ditch sediments and western portion (first 800 linear feet) of north and south slopes of the Northern Channel soil
- Contaminated sediment removal from Northern Channel and ditches
- Contaminated soil removal from north and south slopes of western portion (first 800 linear feet) of Northern Channel and the Lockheed berm near the eastern end of the Northern Channel
- Confirmation sampling of excavated areas
- Drying of sediments in sediment stockpile area
- Sediment, soil, debris, and water disposal

It is anticipated that approximately 65,000 cubic yards of sediment and soil will be excavated from Site 27, which includes 10 percent for over-excavation and 25 percent for bulking (TtEMI, 2003). Approximately 0.5 million gallons of water are anticipated to be collected in a detention/settling basin and then pumped to Baker tanks during sediment drying activities. Sediment, soil, debris and water samples will be collected as discussed in [Section 2.0](#).

1.3 QUALITY OBJECTIVES AND CRITERIA

The following sections present the DQOs and QA objectives identified for the proposed field activities at Site 27.

1.3.1 Data Quality Objectives

DQOs are statements that specify the quantity and quality of the data required to support project decisions. DQOs were developed for this project using the seven-step process listed in *Data Quality Objectives Process for Hazardous Waste Site Investigations* (EPA, 2000a). The DQOs are presented in [Table C.1-2](#). The QC procedures, as well as the associated field sampling procedures for this project, will be focused on achieving these DQOs in a timely, cost-effective,

and safe manner. Deviations from the DQOs will require defining the cause or causes for noncompliance and will initiate the process of determining whether additional sampling and analyses will be required to attain project goals.

1.3.2 Project Quality Assurance Objectives

All analytical results will be evaluated in accordance with precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters to ensure the attainment of project specific DQOs and in conjunction with the *Quality Systems Manual for Environmental Laboratories* (DoD, 2005). Of these PARCC parameters, precision and accuracy will be evaluated quantitatively through the collection of the QC samples listed in [Table C.1-3](#). Precision and accuracy goals for these QC samples are listed in [Attachment A](#).

The subsections below detail the objectives relating to each of the PARCC parameters.

1.3.2.1 Precision

Precision is a measure of the reproducibility among a set of replicate results or the agreement among repeat observations made under the same conditions. *Analytical* precision is the measurement of the variability associated with duplicate or replicate analyses. *Total* precision is the measurement of the variability associated with the entire sampling and analysis process. It is determined by analysis of duplicate samples and measures variability introduced by both the laboratory and field operations. Matrix duplicate spiked samples will be analyzed to assess field and analytical precision. The precision measurement is determined using the relative percent difference (RPD) between the duplicate sample results. The RPD is calculated according to the following formula:

$$RPD = \frac{|A - B|}{(A + B)/2} \times 100\%$$

where: A = first duplicate concentration

B = second duplicate concentration

For this project, the parameters evaluated to assess precision are matrix spike/matrix spike duplicate (MS/MSD) samples. Goals for sample collection and analysis are set at 5 percent for MS/MSD samples, as listed in [Table C.1-3](#).

For this project, MS/MSD samples will be collected for all samples, except waste characterization samples. [Attachment A](#) presents precision goals for Site 27 field sampling activities based on percent RPD for MS/MSD.

1.3.2.2 Accuracy

Accuracy is the degree of agreement between an analytical measurement and a reference accepted as a true value. A program of sample spiking will be conducted to evaluate laboratory accuracy. This program consists of the MS and MSD samples, laboratory control spikes (LCS) or blank spikes, and surrogate standards. The results of the spiked samples are used to calculate the percent recovery for evaluating accuracy according to the following formula:

$$\text{Percent Recovery} = \frac{S - C}{T} \times 100$$

where: S = Measured spike sample concentration

C = Sample concentration

T = True or actual concentration of the spike

MS and MSD samples will be prepared and analyzed at a frequency of 5 percent for all samples. LCS or spike blanks are also analyzed at a frequency of 5 percent. Surrogate standards are added to every sample analyzed for organic constituents.

[Attachment A](#) presents accuracy goals for the Site 27 sampling activities based on the percent recovery of MS, laboratory control, and surrogate spike samples. Results that fall outside the accuracy goals will be further evaluated on the basis of other QC samples.

1.3.2.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent the characteristics of a population, variations in a parameter at a sampling point, or an environmental condition that they are intended to represent. For this project, representative data will be obtained through careful selection of sampling locations and analytical parameters. Representative data will also be obtained through proper collection and handling of samples to avoid interference and minimize contamination.

Representativeness of data will also be ensured through established field and laboratory procedures and their consistent application. To aid in evaluating the representativeness of the sample results, field and laboratory blank samples will be evaluated for the presence of contaminants. Data determined to be non-representative, by comparison with existing data, will be used only if accompanied by appropriate qualifiers and limits of uncertainty.

1.3.2.4 Completeness

Completeness is a measure of the percentage of project-specific data that are valid. Valid data are obtained when samples are collected and analyzed in accordance with QC procedures outlined in this SAP, and when none of the QC criteria that affect data usability are exceeded. When all data

validation is completed, the percent completeness value will be calculated by dividing the number of useable sample results by the total number of sample results planned for this investigation.

As discussed further in [Section 4.2](#), completeness will also be evaluated as part of the data quality assessment process (EPA, 2000b). This evaluation will help determine whether any limitations are associated with the decisions to be made based on the data collected.

1.3.2.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another. Comparability of data will be achieved by consistently following standard field and laboratory procedures and by using standard measurement units in reporting analytical data. Analytical methods selected for each of the project sites are consistent with the methods used during previous investigations at these sites.

1.3.2.6 Detection and Quantitation Limits

The method detection limit (MDL) is the minimum concentration of an analyte that can be reliably distinguished from background noise for a specific analytical method. The quantitation limit represents the lowest concentration of an analyte that can be accurately and reproducibly quantified in a given sample matrix. PRRLs are contractually specified maximum quantitation limits for a sample matrix and are typically several times the MDL to allow for matrix effects. PRRLs are set liberally to establish minimum criteria for laboratory performance; actual laboratory quantitation limits may be substantially lower.

[Attachment B](#) contains a comparison of the PRRLs for the selected analytical methods in comparison to the RAOs for sediments and soil. The purpose of this comparison is to show that the selected analytical methods and associated PRRLs are capable of quantifying COPECs at or below the RAOs.

1.4 PROJECT ORGANIZATION

[Figure C.1-3](#) presents the organization of the project team that developed this SAP. [Table C.1-4](#) presents the responsibilities and contact information for key personnel that will be involved with sampling activities during the implementation of the remedial action for Site 27..

1.5 SPECIAL TRAINING AND CERTIFICATION

This section outlines the training and certification required to complete the activities described in this SAP. The following sections describe the general requirements for the selected contractor's personnel working on site.

1.5.1 Fieldwork Training

The contractor's sampling team will be adequately trained in field methods and sampling procedures outlined in this plan. Specifically, the sampling team will have training in the following field activities:

- Soil, sediment, debris and water sampling, sample handling, packaging, and shipping
- Use of related field equipment
- Handling of investigation-derived waste (IDW)

Training will be provided by the contractor's field team leader that is required to have a minimum of 3 years of direct field experience with soil, sediment, debris and water sampling, sample handling, sample packaging and sample shipping, field equipment operation, and handling of hazardous and non-hazardous waste.

1.5.2 Health and Safety Training

Personnel who work at hazardous waste project sites are required to meet the Occupational Safety and Health Administration (OSHA) training requirements defined in Title 29 Code of Federal Regulations [29 CFR, Part 1910.120(e)]. These requirements are: (1) 40 hours of formal off-site instruction; (2) a minimum of 3 days of actual on-site field experience under the supervision of a trained and experienced field supervisor; and (3) 8 hours of annual refresher training.

Field personnel who directly supervise employees engaged in hazardous waste operations also receive at least 8 additional hours of specialized supervisor training. The supervisor training covers health and safety program requirements, training requirements, personal protective equipment (PPE) requirements, spill containment program, and health-hazard monitoring procedures and techniques. At least one member of every sampling team will maintain current certification in the American Red Cross "Multimedia First Aid" and "Cardiopulmonary Resuscitation (CPR) Modular," or equivalent.

Copies of health and safety training records, including course completion certifications for the initial and refresher health and safety training, specialized supervisor training, and first aid and CPR training, are to be maintained in the contractor's project files. A Health and Safety Plan will be developed by the contractor for this project and a copy will be on site at all times while work is being done.

Before work begins at a specific hazardous waste project site, the contractor's personnel are required to undergo site-specific training that thoroughly covers the following areas:

- Names of personnel and alternates responsible for health and safety at the project site
- Health and safety hazards present on site

- Selection of the appropriate personal protection levels
- Correct use of PPE
- Work practices to minimize risks from hazards
- Safe use of engineering controls and equipment on site
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate over-exposure to hazardous substances

1.6 DOCUMENTS AND RECORDS

Documentation is critical for evaluating the success of any environmental data collection activity. The following sections discuss the requirements for documenting field activities and for preparing laboratory data packages. This section also describes reports that will be generated as a result of the sampling activities at Site 27.

1.6.1 Field Logbook

Complete and accurate documentation is essential to demonstrate that field measurement and sampling procedures are carried out as described in the SAP. Field personnel will use permanently bound field logbooks with sequentially numbered pages to record and document field activities. The logbook will list the contract name and number, the contract task order (CTO) number, the project name and number, the site name and location, and the names of subcontractors, the service client, and the Project Manager. At a minimum, the following information will be recorded in the field logbook:

- Name and affiliation of all on-site personnel or visitors
- Weather conditions during the field activity
- Summary of daily activities and significant events
- Information regarding sample collection including collection date and time, sample ID, sample location, sample matrix (e.g., water or soil), sample type (e.g., regular, duplicate, blank, grab, composite), and sampling depth
- Notes of conversations with coordinating officials
- References to other field logbooks or forms that contain specific information
- Discussions of problems encountered and their resolution
- Discussions of deviations from the SAP or other governing documents
- Description of all photographs taken

Changes or corrections will be made by crossing out the item with a single line, initialing by the person performing the correction, and dating the correction. The original item, although erroneous, will remain legible beneath the cross-out. The new information will be written above the crossed-out item. Corrections will be written clearly and legibly with indelible black or blue ink.

1.6.2 Summary Data Package

Laboratory subcontractors will prepare summary data packages in accordance with the instructions provided in the EPA Contract Laboratory Program (CLP) statements of work (SOW) (EPA, 1999a; 2000c). The summary data package will consist of a case narrative, copies of all chain-of-custody (COC) records, sample results, and QA/QC summaries. The case narrative will provide the following information:

- Laboratory name, project name, CTO number, project order number, sample delivery group (SDG) number, and a table that cross-references client and laboratory sample IDs
- Detailed documentation of all sample shipping and receiving, preparation, analytical, and quality deficiencies, including analyses performed without an American Association for Laboratory Accreditation (A2LA)-certified standard
- Thorough explanation of all instances of manual integration
- Copies of all associated nonconformance and corrective action forms that will describe the nature of the deficiency and the corrective action taken
- Copies of all associated sample receipt notices

Additional summary data package requirements are outlined in [Table C.1-5A](#). The laboratory will provide the contractor with two copies of the summary data package within 21 calendar days after they receive the last sample in the SDG.

1.6.3 Full Data Package

When a full data package is required, the laboratory will prepare data packages in accordance with the instructions provided in the EPA CLP statements of work (EPA, 1999a; 2000c). Full data packages will contain all of the information from the summary data package and all associated raw data. Full data package requirements are outlined in [Table C.1-5B](#). Full data packages are due to the contractor within 21 calendar days after the last sample in the SDG is received. Unless otherwise requested, the laboratory subcontractor will deliver one copy of the full data package.

1.6.4 Electronic Data Deliverables Format

Electronic data deliverables (EDDs) are required for all analytical results. An automated laboratory information management system (LIMS) must be used to produce the EDD. Manual creation of the deliverable (data entry by hand) is unacceptable. The laboratory will verify EDDs internally before they are issued. The EDD will correspond exactly to the hard-copy data. No duplicate data will be submitted. EDDs will be delivered in a format compatible with Naval Electronic Data Deliverable (NEDD) standards as described in *Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards* (NFECSW, 2005). Results that will be provided in all EDDs are as follows:

- Target analyte results for each sample and associated analytical methods requested on the COC record
- Method and instrument blanks and preparation and calibration blank results reported for the SDG
- Percent recoveries for the spike compounds in the MS, MSDs, blank spikes, or LCSs
- Matrix duplicate results reported for the SDG

Electronic and hard-copy data must be retained for a minimum of 3 and 7 years, respectively, after final data have been submitted. The subcontractor will use an electronic storage device capable of recording data for long-term, off-line storage. Raw data will be retained on an electronic data archival system.

1.6.5 Reports Generated

A Construction Completion Report will be prepared at the conclusion of remedial activities. The report will consist of the details and documentation of all activities associated with implementation of the remedial design, including as-built drawings, field change requests, waste characterization and soil confirmation sampling results, and waste manifests.

2.0 DATA GENERATION AND ACQUISITION

This section describes the requirements for the following:

- Sampling Process Design ([Section 2.1](#))
- Sample Collection Methodology ([Section 2.2](#))
- Sample Handling and Custody ([Section 2.3](#))
- Analytical Methods ([Section 2.4](#))
- Quality Control ([Section 2.5](#))
- Equipment Testing, Inspection, and Maintenance ([Section 2.6](#))
- Instrument Calibration and Frequency ([Section 2.7](#))
- Inspection and Acceptance of Supplies and Consumables ([Section 2.8](#))
- Data Management ([Section 2.9](#))

2.1 SAMPLING PROCESS DESIGN

The sediment, soil, debris and water samples collected from this field effort will provide waste characterization and confirmation data for Site 27. Sample results for waste characterization will be used to segregate the waste during excavation activities, and confirmation sample results will be used to confirm that the excavation area is below the Remedial Action Objectives (RAOs) for sediments and soil. In addition, water samples from the treatment system will be used to monitor discharge requirements associated with discharging the water separated from the sediments back into the Northern Channel. The following subsections discuss the proposed sample locations and planned chemical analyses.

The proposed analyses, analytical methods, and quality control (QC) samples for all samples collected are summarized in [Table C.2-1](#).

2.1.1 In Situ Sediment Sampling of Northern Channel and Ditches for Waste Characterization

In situ sediment samples will be collected within the Northern Channel, North Patrol Road Ditch and Marriage Road Ditch at a frequency of one sample every 50 linear feet for waste characterization purposes. In situ waste characterization samples will be collected in the areas to be excavated shown in [Figure C.1-2](#). Sediment samples will be delivered to the analytical laboratory and analyzed for the COPECs. Ten percent of the sediment samples collected will be analyzed for additional disposal facility requirements. A detailed analyte list is provided in [Attachment B](#). Based on the results of the in situ sampling activities, the sediment from each 50

linear foot section will be directed to either the non-hazardous or the non-Resource Conservation and Recovery Act (RCRA) (California hazardous) staging stockpiles.

2.1.2 In Situ Soil Sampling of Northern Channel Slopes for Waste Characterization

In situ soil samples will be collected (one sample per 50 linear feet) along both the north and south slopes of the western portion (first 800 linear feet) of the Northern Channel and the Lockheed berm near the eastern end of the Northern Channel for waste characterization purposes. In situ waste characterization samples will be collected in the proposed excavation area along north and south slopes of the western portion of the Northern Channel (excavation area shown in [Figure C.1-2](#)). Soil samples will be delivered to the analytical laboratory and analyzed for the chemicals of potential concern (COPECs). Ten percent of the soil samples collected will be analyzed for additional disposal facility requirements. A detailed analyte list is provided in [Attachment B](#). Based on the results of the in situ sampling activities, the soil from each 50-linear foot section will be directed to either the non-hazardous or the non-RCRA (California hazardous) staging stockpiles.

2.1.3 Debris Pile Sampling for Waste Characterization

The debris pile will be removed and associated soil below the pile will be removed to 1 foot below ground surface (bgs) and stockpiled. Once stockpiled, one debris sample will be collected approximately every 500 cubic yards for waste characterization purposes. Samples will be delivered to the analytical laboratory and analyzed for the COPECs. Ten percent of the debris samples collected will be analyzed for additional disposal facility requirements. A detailed analyte list is provided in [Attachment B](#).

2.1.4 Water Sampling for Waste Characterization

In order to establish a baseline characterization of the water in the channel prior to excavation activities, one water sample will be collected from the channel and sent to the laboratory to analyze for Title 22 metals, polychlorinated biphenyls (PCBs), pesticides, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). The excavated sediment from the Northern Channel and ditches will then be segregated by waste type (non-hazardous or non-RCRA) and spread out to dry in the sediment stockpile area. Water runoff from the sediment drying pads will be collected in a detention/settling basin, pumped through the on-site treatment system, and then pumped into 21,000-gallon Baker tanks. Each week, one representative wastewater sample will be collected and analyzed for total dichlorodiphenyltrichloroethane (DDT), total PCBs, and turbidity prior to discharge. A detailed analyte list and discharge requirements are provided in [Attachment B](#). If the wastewater samples meet discharge requirements, the water will be discharged back to the Northern Channel. If analytical results do not meet the discharge requirements, water will be treated by the treatment system until the discharge requirement is met.

2.1.5 Sampling for Bench-scale Testing

Prior to excavation activities, a mixture of sediment and water from the Northern Channel will be collected and sent to a testing facility that will pour the liquid slurry down a column consisting of 16-ounce geotextile fabric and 12 inches of sediment layer. The filtrate that is recovered after passing through the column will be collected and tested for turbidity. The filtrate water would then be filtered using various size filters to determine the approximate particle size and best filter system to be used in the field. If the particles are too small to be filtered effectively, an additive approved by the California Water Board, Chitosan, would be tested. A dosage test with Chitosan coagulant will be performed until the particles are of a large enough size to be filtered. The filtrate after being filtered through different filter types will be tested for turbidity by a turbid meter or equivalent.

The purpose of performing a bench-scale test is to find the filter types that optimize the on-site treatment system configuration to meet the discharge requirement for turbidity. Turbidity should be no more than 10 percent above background if background is 50 nephelometric turbidity units (NTUs) or higher. If background is less than 50 NTUs, then the discharge limit is no more than 5 NTUs greater than background levels. The baseline value for turbidity will be determined during baseline sampling described in [Section 2.1.4](#).

2.1.6 Confirmation Sampling of Northern Channel and Ditches

Confirmation samples will be collected once the sediment has been removed down to the clay layer in the Northern Channel, North Patrol Road Ditch, and Marriage Road Ditch. One sample at a randomly selected location will be collected every 50 linear feet of the excavated channel and ditches. Sediment samples will be delivered to the analytical laboratory and analyzed for the COPECs. Results will be compared to the Remedial Action Objectives (RAOs) for sediments. If the RAOs for sediments are not met within a 50-foot linear section, that entire section will be excavated 6 inches and then another confirmation sample will be collected at a randomly selected location. This process will be repeated until the confirmation sample meets the RAOs for sediments or to a maximum depth of 2 feet.

In order to maintain the integrity of the channel clay liner, a maximum of 2 feet of the clay layer is allowed to be excavated. If the confirmation sediment sample does not meet the RAOs for sediments after 2 feet of additional excavation, then the Navy will be notified since additional excavation may cause infiltration to the channel from adjacent areas. The clay layer did not contain COPECs at or above the RAOs in the Northern Channel according to the *Final Record of Decision [ROD], Site 27 - Northern Channel* (Base Realignment and Closure [BRAC] Program Management Office [PMO] West, 2005).

2.1.7 Confirmation Sampling of Northern Channel Slopes

Confirmation samples will be collected once the soil has been removed down to 1 foot bgs along the north and south slopes of the Northern Channel (western portion, first 800 linear feet) and the Lockheed berm near the eastern end of the Northern Channel. One sample at a randomly selected location will be collected every 50 linear feet along both the north and south slopes along the Northern Channel and the Lockheed berm. Soil samples will be delivered to the analytical laboratory and analyzed for the COPECs. Results will be compared to the RAOs for soil. If the RAOs for soil are not met within a 50-foot linear section, that entire section will be excavated 6 inches and then an additional confirmation sample will be collected at a randomly selected location. This process will be repeated until the confirmation sample meets the RAOs for soil or to a maximum depth of 2 feet. RAOs for soil are listed in Section 1.1.6.

In order to maintain the integrity of the channel clay liner, a maximum of 2 feet of the clay layer is allowed to be excavated. If the confirmation sediment sample does not meet the soil RAOs after 2 feet of additional excavation, then the Navy will be notified. The clay layer did not contain COPECs at or above the RAOs in the Northern Channel according to the ROD (BRAC PMO West, 2005). Eventually, the slopes will be backfilled upon approval by the Navy.

2.1.8 Confirmation Sampling of the Debris Pile Area

Confirmation samples will be collected using a 50-foot by 50-foot grid system, after the debris pile and debris/soil to 1 foot bgs is removed. One confirmation sample will be collected at a randomly selected location per 50-foot by 50-foot grid. Soil samples will be delivered to the analytical laboratory and analyzed for the COPECs. Results will be compared to the RAOs for soil. If the RAOs are not met within a 50-foot by 50-foot grid section, that entire section will be excavated 1 foot and then an additional confirmation sample will be collected at a randomly selected location. This process will be repeated until the confirmation sample meets the RAOs or groundwater is encountered.

2.1.9 Sampling of Import Materials

Backfill soil or crushed aggregate base will be imported for the turnouts that will be constructed along the North Access Road berm. In addition, clay will be imported for the grading of the Northern Channel and ditches, once contaminated sediment has been removed. The slope of the channel and ditches will be graded per the Remedial Design Plan.

Prior to importing backfill soil, crushed aggregate base or clay, each source will be tested for both geotechnical properties. The type and frequency of geotechnical testing that is required from each source are provided in the Specifications (Appendix J of the Remedial Design Plan) and are not discussed here.

Samples will be collected for chemical analysis from each imported material source that is medium sand grade or finer as defined by the Unified Soil Classification Service (USCS). prior to use, as described in [Section 2.2.9](#). The Department of Toxic Substances Control (DTSC) *Information Advisory for Clean Imported Fill Material* (DTSC, 2001) will be used as a guidance document to determine the sampling frequency and analysis. Imported material results will be compared to the RAOs for soil listed in Section 1.1.6. The RAOs for soil is based on the [U.S. Environmental Protection Agency] *EPA Region 9 Residential Preliminary Remediation Goals* (PRGs) (EPA, 2004a). Imported material screening levels are listed in Table B-1. All materials, at a minimum, will be analyzed for Title 22 metals, pesticides, and PCBs. In addition to these analyses, a current certificate will be obtained from the facility providing the material to ensure that the material does not contain asbestos. If the facility cannot provide a certificate, then asbestos analysis will be required, unless this same material has been sampled by the contractor within the last year and is below the required limit for asbestos.

2.2 SAMPLE COLLECTION METHODOLOGY

This section describes the procedures for sample collection, including sampling methods and equipment, sample preservation requirements, decontamination procedures, and management of investigation-derived waste (IDW). Sediment, soil, debris and water sampling will be conducted in accordance with this Sampling and Analysis Plan (SAP) and in conjunction with the Remedial Design Plan. This document will be on site at all times during the sampling. The appropriate sample containers, holding times, and preservation methods for each analysis method are listed in [Table C.2-2](#). The analytes, reporting limits, and screening levels required are listed in [Attachment B](#).

2.2.1 In Situ Sediment Sampling of Northern Channel and Ditches for Waste Characterization

One in situ sediment sample will be collected for waste characterization purposes at approximately the center of each 50-foot linear section of the Northern Channel, North Patrol Road Ditch and Marriage Road Ditch, to be excavated. A portable global positioning system (GPS) unit or similar will be used to record each in situ sample location. The samples will be collected using a discrete sludge sampler or equivalent from zero to 6 inches bgs, yielding approximately 200 samples in the Northern Channel, approximately 86 samples in North Patrol Road Ditch, and approximately 46 samples in Marriage Road Ditch. Sediment samples in the Northern Channel and ditches will be collected from approximately the center of the 50-foot linear section as follows:

1. Using a discrete sludge sampler or equivalent, one sediment sample will be collected from each 50-foot linear section along the surface of the Northern Channel, North Patrol Road Ditch, and Marriage Road Ditch. If needed, a hand-trowel, disposable scoop, or equivalent will be used to fill sample containers.

2. Non-disposable sampling equipment will be decontaminated as detailed in [Section 2.2.10](#) between each sample acquisition.
3. Each sample will be properly labeled. Clear packing tape will be placed over sample labels to secure and protect them. Each sample will then be placed in a resealable plastic bag and subsequently in a cooler (or similar container) for shipment to the analytical testing laboratory.
4. The sample number, date, time, and a description of the sample will be recorded on the chain-of-custody (COC) record and in the field logbook.

Each sample will be analyzed for the following: Title 22 metals (COPECs only), PCBs (COPECs only), and pesticides (COPECs only). Every tenth sample will also be analyzed for volatile organic compounds (VOCs) (see below for En Core sampling methodology), semivolatile organic compounds (SVOCs), Title 22 metals, PCBs, and pesticides as required by the disposal facility. Soluble Threshold Limit Concentration (STLC) and Toxicity Characteristic Leaching Procedure (TCLP) will be performed if the total concentration exceeds 10 times the STLC limit or 20 times the TCLP limit.

At every tenth sample location, En Core samplers and EPA Method 5035 will be used for the collection and preparation of sediment samples for volatile analysis.

Three En Core samples will be collected at every tenth sample location within the Northern Channel, North Patrol Road Ditch and Marriage Road Ditch for VOC analysis.

1. Holding the coring body, the plunger rod will be pushed down until the small o-ring rests against the tabs. This will ensure that the plunger will move easily.
2. The locking lever on the En Core T-handle will be depressed. The coring body, with the plunger end first, will be placed into the open end of the T-handle, aligning the slots of the coring body with the locking pins in the T-handle. The coring body will be twisted clockwise to lock the pins in the slots. The sampler will be checked to ensure that it is locked in place. The sampler will now be ready for use.
3. By holding the T-handle, the coring body will be pushed into the jar containing the sediment until the coring body is full. When full, the small o-ring will be centered in the T-handle viewing hole. The sampler will then be removed from the sediment and any excess sediment will be wiped from the coring body exterior.
4. The coring body will be capped while it is still on the T-handle. The cap will be pushed over the flat area of the ridge. To lock the cap in place, the cap will be pushed and twisted so that it seals the sampler.
5. The capped sampler will be removed by depressing the locking lever on the T-handle while twisting and pulling the sampler from the T-handle.
6. This procedure will be performed until the appropriate amount of En Core samples are collected for each sample location. For matrix spike/matrix spike duplicate (MS/MSD) analyses, three additional En Core samples each are required (total of six En Core samples).

7. The three En Core samples will be placed in its foil bag and sealed. The sample label on the outside of the bag will be completed and clear tape will be placed over the label. The foil bag will be placed in a resealable bag, a signed custody seal will be placed over that bag, the bag will be placed in another resealable bag, and then placed immediately on ice.
8. If En Core samplers are not usable due to the type of media (i.e., saturated soil or a soil matrix that does not break into small enough pieces to fit into an En Core), then EPA Method 5030B will be used and the sediment in the liner will be used by the laboratory for VOC analysis.

2.2.2 In Situ Soil Sampling of Northern Channel Slopes for Waste Characterization

One in situ soil sample will be collected for waste characterization purposes at the approximate center of each 50-foot linear section of both the north and south slopes along the Northern Channel (western portion, first 800 linear feet) and the Lockheed berm near the eastern end of the Northern Channel to be excavated. A portable GPS unit will be used to record each in situ sample location. The samples will be collected by using a mini excavator, hand auger, or equivalent to collect surface soil from zero to 6 inches bgs, yielding approximately 32 samples for the north and south slopes of the Northern Channel. Soil samples along the north and south slopes of the Northern Channel will be collected at approximately the midpoint of the slope (halfway between the top of the slope and the channel's water level) within each 50-foot linear section as follows:

1. Using a mini excavator, hand auger, or equivalent, surface soil will be collected from zero to 6 inches bgs from the center of each 50-foot linear section at the midpoint of the slope. If needed, a hand-trowel, disposable scoop, or equivalent will be used to fill containers listed in Table C.2-2.
2. Non-disposable sampling equipment will be decontaminated as detailed in [Section 2.2.10](#) between each sample acquisition.
3. Each sample will be properly labeled. Clear packing tape will be placed over sample labels to secure and protect them. Each sample will then be placed in a resealable plastic bag and subsequently in a cooler (or similar container) for shipment to the analytical testing laboratory.
4. The sample number, date, time, and a description of the sample will be recorded on the COC record and in the field logbook.

Each sample will be analyzed for the following: Title 22 metals (COPEC only), PCBs (COPEC only), and pesticides (COPEC only). Every tenth sample will be analyzed for VOCs (see below for En Core sampling methodology), SVOCs, Title 22 metals, PCBs, and pesticides as required by the disposal facility. STLC and the TCLP will be performed if the total concentration exceeds 10 times the STLC limit or 20 times the TCLP limit.

At every tenth sample location, En Core samplers and EPA Method 5035 will be used for the collection and preparation soil samples for volatile analysis as described in [Section 2.2.1](#).

2.2.3 Debris Pile Sampling for Waste Characterization

One debris sample from the debris stockpile will be collected approximately every 500 cubic yards for waste characterization purposes. The samples will be collected as follows:

1. Debris samples will be collected approximately every 500 cubic yards.
2. A chisel, hammer and/or hand trowel will be used to break-up the sample depending on the composition of the debris material and the material will be placed in containers listed in Table C.2-2.
3. Non-disposable sampling equipment will be decontaminated as detailed in [Section 2.2.10](#) between each sample acquisition.
4. Each sample will be properly labeled. Clear packing tape will be placed over sample labels to secure and protect them. Each sample will then be placed in a resealable plastic bag and subsequently in a cooler (or similar container) for shipment to the analytical testing laboratory.
5. The sample number, date, time, and a description of the sample will be recorded on the COC record and in the field logbook.

Each sample will be prepared and analyzed for the following: Title 22 metals, PCBs, and pesticides. Every tenth sample will also be analyzed for SVOCs as required by the disposal facility. Samples will not be analyzed for VOCs since En Core sampling methodology is not applicable to debris sampling. STLC and the TCLP will be performed if the total concentration exceeds 10 times the STLC limit or 20 times the TCLP limit.

2.2.4 Water Sampling for Waste Characterization

One water sample will be collected from the channel to establish baseline characterization of the water prior to excavation activities. The baseline sample will be analyzed for Title 22 metals, PCBs, pesticides, VOCs, SVOCs, and turbidity. Once wastewater has been treated by the on-site treatment system, wastewater will be pumped into Baker tanks for storage. Each week, one representative wastewater sample will be collected from the Baker tanks and analyzed for total DDT, total PCBs, and turbidity prior to discharging the wastewater. Water samples will be collected using a disposable bailer or similar device and transferred to containers listed in Table C.2-2. Water samples are for discharge purpose and will be analyzed as unfiltered samples. VOC samples will be collected first as described below:

1. The water samples will be carefully collected into 40-milliliter (mL) volatile organic analysis (VOA) vials carefully to minimize aeration.
2. The vial will be filled up to the lid until a positive meniscus is formed.
3. The vial will be capped immediately, but slowly.

4. The sample will be checked for the presence of air bubbles.
5. If an air bubble is present, the collected sample will be discarded and re-sampled using a new vial.
6. The previous steps will be repeated until an air bubble-free sample is collected.
7. Each sample will be properly labeled. Clear packing tape will be placed over sample labels to secure and protect them. Each sample will then be placed in a resealable plastic bag and subsequently in a cooler (or similar container) for shipment to the analytical testing laboratory.
8. The sample number, date, time, and a description of the sample will be recorded on the COC record and in the field logbook.

Any sediment that has accumulated in the Baker tanks will be placed in the non-RCRA (California hazardous) sediment stockpile and be disposed of at the appropriate facility.

2.2.5 Sampling for Bench-scale Test

A mixture of sediment and water will be collected from the channel for bench-scale testing. The sample will be sent to an off-site testing facility for a bench-scale simulation of the treatment system that will treat wastewater generated from the Site 27 sediment excavation. The bench-scale test sample will be collected as follows:

1. Standing over the center of the existing bridge that crosses the channel, a sediment pump or equivalent will be lowered into the Northern Channel.
2. The hose connected to the sediment pump will be placed into a 55-gallon drum and the pump will be started.
3. The pump will be stopped after well-mixed water and sediment have been collected in the drum.
4. The pump will be removed from the channel and placed in the 55-gallon drum with well-mixed water and sediment.
5. The mixture will be pumped into two 5-gallon buckets and the lids will be placed after the buckets are $\frac{3}{4}$ full and packing tape will be placed over the lids of the buckets.
6. The sample will be properly labeled and clear packing tape will be placed over sample label.
7. The buckets will be picked up by a representative from the testing facility that will be conducting the bench-scale testing.
8. The sample number, sample date, time and description of the sample will be recorded on the COC record and in the field logbook.

2.2.6 Confirmation Sampling of Northern Channel and Ditches

The contaminated sediment within the Northern Channel, North Patrol Road Ditch and Marriage Road Ditch will be removed down to the clay layer. One sample at a randomly selected location will be collected in the clay layer within every 50-foot linear section of the excavated channel and ditches for confirmation that COPECs are below RAOs for sediment samples. The samples will be collected using a mini excavator, hand auger, or equivalent from zero to 6 inches bgs, yielding approximately 200 samples in the Northern Channel, approximately 86 samples in the North Patrol Road Ditch, and approximately 46 samples in Marriage Road Ditch. Each confirmation sample location will be surveyed. Each sample will be collected as follows:

1. Using a mini excavator, hand auger, or equivalent, a confirmation sample will be collected from zero to 6 inches bgs from the center of each 50-foot linear section. If needed, a hand-trowel, disposable scoop, or equivalent will be used to fill containers listed in [Table C.2-2](#).
2. Non-disposable sampling equipment will be decontaminated as detailed in [Section 2.2.10](#) between each sample acquisition.
3. Each sample will be properly labeled. Clear packing tape will be placed over sample labels to secure and protect them. Each sample will then be placed in a resealable plastic bag and subsequently in a cooler (or similar container) for shipment to the analytical testing laboratory.
4. The sample number, date, time, and a description of the sample will be recorded on the COC record and in the field logbook.

Each sample will be analyzed for the following: Title 22 metals (COPECs only), PCBs (COPECs only), and pesticides (COPECs only). Results will be compared to the RAOs for sediments listed in [Section 1.1.6](#). Every tenth sample will also be analyzed for VOCs (see [Section 2.2.1](#) for En Core sampling methodology), SVOCs, Title 22 metals, PCBs, and pesticides as required by the disposal facility. STLC and TCLP will be performed if the total concentration exceeds 10 times the STLC limit or 20 times the TCLP limit.

2.2.7 Confirmation Sampling of Northern Channel Slopes

The contaminated soil along the north and south slopes of the Northern Channel (western portion, first 800 linear feet) and the Lockheed berm near the eastern end of the Northern Channel will be excavated 6 inches bgs. One sample at a randomly selected location will be then collected within every 50-foot linear section of the excavated slopes for confirmation purposes. The samples will be collected using a mini excavator, hand auger, or equivalent from zero to 6 inches bgs, yielding approximately 32 samples for the north and south slopes of the Northern Channel. Confirmation samples along the north and south slopes of the Northern Channel will be collected as described in [Section 2.2.6](#). Each confirmation sample location will be surveyed.

Each sample will be analyzed for the following: Title 22 metals (COPECs only), PCBs (COPECs only), and pesticides (COPECs only). Results will be compared to the RAOs for soil listed in [Section 1.1.6](#). Every tenth sample will also be analyzed for VOCs (see Section 2.2.1 for En Core sampling methodology), SVOCs, Title 22 metals, PCBs, and pesticides as required by the disposal facility. STLC and TCLP will be performed if the total concentration exceeds 10 times the STLC limit or 20 times the TCLP limit.

2.2.8 Confirmation Sampling of the Debris Pile Area

Confirmation samples will be collected using a 50-foot by 50-foot grid system within the debris pile footprint. One confirmation sample will be collected at a randomly selected location per 50-foot by 50-foot grid. The debris area is approximately 30,000 square feet, which calculates to 12 samples. Each confirmation sample location will be surveyed. Each sample will be collected as follows:

1. A sample location within a grid will be determined by generating random numbers that would correlate to x and y coordinates.
2. A grab sample will be collected using a hand-trowel, disposable scoop, or equivalent to access each x and y coordinate in each grid. Samples will be placed into containers listed in Table C.2-2.
3. Non-disposable sampling equipment will be decontaminated as detailed in [Section 2.2.10](#) between each sample acquisition.
4. Each sample will be properly labeled. Clear packing tape will be placed over sample labels to secure and protect them. Each sample will then be placed in a resealable plastic bag and subsequently in a cooler (or similar container) for shipment to the analytical testing laboratory.
5. The sample number, date, time, and a description of the sample will be recorded on the COC record and in the field logbook.

Each sample will be analyzed for the following: Title 22 metals (COPECs only), PCBs (COPECs only), and pesticides (COPECs only). Results will be compared to the RAOs for soil listed in [Section 1.1.6](#).

2.2.9 Sampling of Import Materials

Verification samples will be collected for import materials for each source that is medium sand grade or finer as defined by the USCS. Clay, backfill soil, or crushed aggregate base will be imported for the remedial activities. If the site where the material is being imported from is accessible, then samples will be collected from the site; if the site is not accessible, then a sample of the material will be sent to the project site. The *DTSC Information Advisory for Clean Imported Fill Material* (DTSC, 2001) and *EPA Region 9 Residential Preliminary Remediation Goals* (EPA, 2004a) will be used as guidance documents to determine the sampling frequency,

analysis, and action levels. Import material samples will be analyzed, at a minimum, for Title 22 metals, pesticides, and PCBs.

Backfill samples will be collected as follows:

1. A hand-auger, disposable scoop, or similar device will be used to access and collect each sample. Grab samples will be collected into containers listed in Table C.2-2.
2. En Core samples for VOC analysis will be collected as described in [Section 2.2.1](#).
3. Each sample will be properly labeled. Clear packing tape will be placed over sample labels to secure and protect them. Each sample will then be placed in a resealable plastic bag and subsequently in a cooler (or similar container) for shipment to the analytical testing laboratory.
4. The sample number, date, time, and a description of the sample will be recorded on the COC record and in the field logbook.

2.2.10 Decontamination

Decontamination of non-disposable sampling equipment will be performed to prevent the introduction of extraneous material into samples and to prevent cross-contamination between samples. All sampling equipment will be decontaminated by steam cleaning or by washing with a nonphosphate detergent such as Liquinox[®] or equivalent. Decontamination water will be collected in 55-gallon drums.

The following steps will be followed for general decontamination of non-disposable sampling equipment:

1. **Wash with nonphosphate detergent and water solution** — This step will reduce the amount of gross contamination from the equipment. Use of a bucket, approximately 75 percent full of solution, is suggested for this step. This detergent solution will be prepared by diluting nonphosphate detergent in potable water as directed by the manufacturer.
2. **Rinse with potable water** — This step will rinse all the detergent solution away from equipment. Use of a bucket, approximately 75 percent full of potable water, is suggested for this step. Periodic changing of this water is required.
3. **Rinse with deionized water** — This step will rinse the equipment of any detergent solution and potable water residues. Rinsing is most effective by applying deionized water from a stainless steel Hudson-type sprayer or Nalgene[™] squeeze bottle while holding equipment over a bucket.
4. **Rinse with deionized water** — This step will be a final rinse of the equipment. Rinsing is most effective by applying deionized water from a stainless steel Hudson-type sprayer or Nalgene[™] squeeze bottle while holding equipment over a bucket.

If equipment rinsate samples are to be collected, laboratory reagent-grade water will be used as an additional rinse after Step 4. Water that is falling off the sampling equipment as is it being

rinsed with the reagent-grade water will be collected in appropriate sample bottles and analyzed for the same parameters as the field samples.

2.2.11 Management of Investigation-derived Waste

IDW that may be generated during this investigation will consist of PPE and decontamination water. Used PPE will be placed in Department of Transportation-approved 55-gallon drums. All water derived from decontamination activities will be placed in the detention basin that will eventually be pumped into the Baker tanks. The wastewater will be sampled, analyzed and disposed as described in [Sections 2.1.4](#) and [2.2.4](#).

At the end of each day or when the site work is completed, whichever occurs sooner, the drums will be moved to a main storage area designated by the Resident Officer in Charge of Construction until ready for disposal. The drums will be properly labeled and stored in a manner consistent with regulatory requirements. In no case will accumulation be allowed to exceed 90 days from the date that the accumulation started.

2.2.12 Sample Containers and Holding Times

The type of sample containers to be used for sample analysis, the sample volumes required, the preservation requirements, and the maximum holding times for sample extraction and analysis are presented in [Table C.2-2](#).

2.3 SAMPLE HANDLING AND CUSTODY

The following subsections describe sample handling procedures, including sample identification and labeling, documentation, COC, and shipping.

2.3.1 Sample Identification

Each sample collected will be given unique sample ID. The sample ID is project-specific and a record of all sample IDs will be kept with the field records and recorded on a COC record. The labeling scheme for sample ID will be identified by a 5-digit number (XX-ZZZ) as follows:

XX:- 2-character designation of the Contract Task Order (CTO) number (for example, 02)

ZZZ: 3-character designation of the consecutive sample number (for example, 004)

For example, in the sample identification number 02-004, “02” represents the CTO number and “004” represents the fourth soil sample collected for the project.

The sample number will be recorded in the field logbook, on the labels, and COC record at the time of sample collection. A complete description of the sample and sampling conditions will be recorded in the field logbook and referenced using the unique sample identification number.

2.3.2 Sample Labels

Sample labels are necessary to prevent misidentification of samples. Sample labels will be filled out in indelible black or blue ink and affixed to sample containers at the time of sample collection. Each sample label will be covered with clear tape. Each sample container will be labeled with the following, at a minimum:

- Sample identification number
- Sample collection date (month/day/year)
- Time of collection (24-hour clock)
- Sampler's initials
- Preservative (if any)
- Analyses required

After labeling, each sample will be immediately placed in a cooler that contains ice to maintain the sample temperature at 4 ± 2 degrees Celsius ($^{\circ}\text{C}$).

2.3.3 Sample Documentation

Documentation during sampling is essential to ensure proper sample identification. Personnel will adhere to the following general guidelines for maintaining field documentation:

- Documentation will be completed in indelible black or blue ink.
- All entries will be legible.
- Errors will be corrected by crossing out with a single line and then dating and initialing the lineout.
- Any serialized documents will be maintained by the contractor and referenced in the site logbook.
- Unused portions of pages will be crossed out, and each page will be signed and dated.

[Section 1.6.1](#) provides additional information on how the contractor will use logbooks to document field activities. The contractor's field team leader (FTL) is responsible for ensuring that sampling activities are properly documented.

2.3.4 Chain-of-custody

The contractor will use standard sample custody procedures to maintain and document sample integrity during collection, transportation, storage, and analysis. A sample will be considered to be in custody if one of the following statements applies:

- It is in a person's physical possession or view.
- It is in a secure area with restricted access.
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal.

COC procedures provide an accurate written record that traces the possession of individual samples from the time of collection in the field to the time of acceptance at the laboratory. The COC record also will be used to document all samples collected and the analysis requested. The field personnel will record the following information on the COC record:

- Project name and number
- Sampling location
- Name and signature of sampler
- Destination of samples (laboratory name)
- Sample identification number
- Date and time of collection
- Number and type of containers filled
- Analysis requested
- Preservatives used (if applicable)
- Filtering (if applicable)
- Sample designation (grab or composite)
- Signatures of individuals involved in custody transfer, including the date and time of transfer
- Airbill number (if applicable)
- Project contact and phone number

Unused lines on the COC record will be crossed out. COC records that are initiated in the field will be signed by field personnel and the airbill number will be recorded. The record will be placed in a waterproof plastic bag and taped to the inside of the shipping container used to transport the samples. Signed airbills will serve as evidence of custody transfer between field personnel and the courier, and between the courier and the laboratory. Copies of the COC record and the airbill will be retained and filed by field personnel before the containers are shipped.

Laboratory COC begins with sample receipt and continues until samples are discarded. Laboratories analyzing samples must follow custody procedures at least as stringent as are required by the EPA Contract Laboratory Program (CLP) Statements of Work (SOWs) (EPA, 1999a; 2000c). The laboratory should designate a specific individual as the sample custodian. The custodian will receive all incoming samples, sign the accompanying custody forms, and retain copies of the forms as permanent records. The laboratory sample custodian will record all pertinent information concerning the samples, including the persons delivering the samples, the date and time received, sample condition at the time of receipt (sealed, unsealed, or broken container; temperature; or other relevant remarks), the sample identification numbers, and any unique laboratory identification numbers for the samples. This information will be entered into a computerized laboratory information management system (LIMS). Once the sample transfer process is complete, the custodian is responsible for maintaining internal logbooks, tracking reports, and other records necessary to maintain custody throughout sample preparation and analysis.

The laboratory will provide a secure storage area for all samples. Access to this area will be restricted to authorized personnel. The custodian will ensure that samples requiring special handling, including samples that are heat- or light-sensitive, radioactive, or have other unusual physical characteristics, will be properly stored and maintained prior to analysis.

2.3.5 Sample Shipment

Immediately after sample labeling, custody seals will be affixed to each sample container. For VOA vials and En Core samples, the custody seal will be placed on the outside of the first resealable bag; then the containers will be placed in a second resealable bag. This will prevent any contact with the adhesive from the custody seal and the samples. Other sample containers will be placed in a resealable plastic bag to protect the sample from moisture and to prevent breakage and potential cross-contamination during transportation to the laboratory. All glass sample containers will be protected with bubble wrap first, then placed in resealable bags if transported by a commercial carrier. VOA vials will be wrapped with bubble wrap, then placed in a resealable bag, a custody seal placed over the bag, and then placed in another resealable bag.

Each cooler will be shipped with a temperature blank. A temperature blank is a container filled with tap water and stored in the cooler during sample collection and transportation. The temperature of the cooler will be recorded by the laboratory on the COC record immediately upon receipt of the samples.

Sample cooler drain spouts will be taped from the inside and outside of the cooler to prevent any leakage.

Samples transported by a laboratory-assigned courier will be packed in a sample cooler with sufficient ice to keep the samples cooled. Two custody seals will be taped across the cooler lid:

one seal in the front and one seal in the back. The COC record will be completed and signed by the courier. The cooler(s) and the top two copies (white and pink) of the COC record will then be released to the courier for transportation to the laboratory.

Samples to be shipped by commercial carrier will be packed in a sample cooler lined with a plastic bag. Double-bagged ice will be added inside the plastic bag at the bottom of the cooler, one layer of sample containers will be placed on the ice, and more double-bagged ice will be placed on top of the containers. This will be repeated until the cooler is filled with ice as the top layer in the cooler. The COC record will include the airbill number, and the “Received By” box will be labeled with the commercial courier’s name. The top two copies of the COC record will be sealed in a double-resealable bag and then taped to the inside of the sample cooler lid. The cooler will be taped shut with strapping tape. Two custody seals will be taped across the cooler lid: one seal in the front and one seal in the back. Clear tape will be applied to the custody seals to prevent accidental breakage during shipment. The pouch for the airbill will be placed on the cooler and secured with clear tape. The airbill will be completed for priority overnight delivery and placed in the pouch. If multiple coolers are being shipped, then the original airbill will be placed on the cooler with the COC record, and copies of the airbill will be placed on the other coolers. The number of packages will be included on each airbill (1 of 2, 2 of 2). Saturday deliveries will be coordinated with the laboratory in advance, and field sampling personnel or their designee must ensure that Saturday delivery stickers are placed on each cooler by the commercial courier.

2.4 ANALYTICAL METHODS

[Table C.2-1](#) presents the analytical methods that will be used to analyze samples collected during the field activities at Moffett, and [Attachment A](#) presents the project quality assurance (QA) objectives and control limits for sample analyses established as part of the data quality objective (DQO) process ([Section 1.3](#)). [Attachment B](#) presents the individual target analytes required for this investigation and their associated project-required reporting limits (PRRLs). The analytical laboratories will attempt to achieve the PRRLs for all the investigative samples collected. In the case of analysis for SVOCs, the Selective Ion Monitoring (SIM) mode will be used to achieve PRRLs that are lower than the action levels listed in [Table B-1](#). If problems occur in achieving the PRRLs, the laboratories will contact the contractor’s Project Chemist immediately and other alternatives will be pursued (such as analyzing an undiluted aliquot and allowing non-target compound peaks to go off-scale) to achieve acceptable reporting limits. In addition, results below the reporting limit but above the method detection limit (MDL) will be reported with appropriate flags to indicate the greater uncertainty associated with these values.

Analysis of samples described in this SAP will be conducted by the off-site laboratories. The analytical method required for this investigation is the EPA SW-846 methods (EPA, 1986) listed in [Attachment B](#). Protocols for laboratory selection and for ensuring laboratory compliance with project analytical and QA/QC requirements are presented in the following subsections.

2.4.1 Selection of Analytical Laboratories

A Navy-approved analytical laboratory will be selected by the contractor to perform this work prior to project initiation.

2.4.1.1 Laboratory Evaluation and Prequalification

Laboratories working under Navy contract are evaluated by the Naval Facilities Engineering Service Center (NFESC). Laboratories must be currently certified by the California Department of Health Services (DHS) Environmental Laboratory Accreditation Program (ELAP) for analysis of hazardous materials for each method specified. Laboratories must also have or obtain similar approval from NFESC. The California DHS ELAP certification and NFESC approval must be obtained before the laboratory begins work.

2.4.1.2 Laboratory Selection and Oversight

The contractor's Project Chemist will prepare a project-specific Laboratory Analytical Statement of Work, a contractual document that specifies requirements for analyses based on the project-specific analytical program. The Project Chemist identifies which of the pre-qualified subcontractor laboratories are capable of performing the work and providing the required turnaround times, project QC, and data deliverables required by this SAP. As part of this process, the project chemist typically contacts the laboratories to discuss the analytical requirements and project schedule. At least two laboratories are contacted to provide a technical and cost proposal to perform the project-specific analytical services. After careful review of the proposals, a specific laboratory is typically selected based on meeting the project-specific analytical and QA/QC requirements, cost, laboratory workload, and project schedule considerations. The Project Chemist forwards the name of the recommended laboratory to the contractor's procurement specialist, who issues a subcontract for the work.

After a laboratory has been selected, the contractor's Project Chemist holds a kickoff meeting with the laboratory project manager. The contractor's Project Manager, procurement specialist, and other key project and laboratory staff may also be involved in this meeting. The kickoff meeting includes a review of analytical and QC requirements in the SAP, the project schedule, and any other logistical support that the laboratory will be expected to provide.

2.4.2 Project Analytical Requirements

This SAP documents project-specific QC requirements for the selected analytical method. Sample volume, preservation, and holding time requirements are specified in [Table C.2-2](#). Requirements for laboratory QC samples are described in [Table C.1-3](#) and in [Section 2.5.2](#). [Attachment A](#) provides project-specific precision and accuracy goals for the method. Analyte lists and PRRLs for each method are documented in [Attachment B](#). Finally, turnaround times may be expedited for some analyses, especially the confirmations samples, to ensure that construction activities are not impeded.

2.5 QUALITY CONTROL

The contractor will assess the quality of field data through regular collection and analysis of field QC samples. Laboratory QC samples will also be analyzed in accordance with referenced analytical method protocols to ensure that laboratory procedures and analyses are conducted properly and that the quality of the data is known.

2.5.1 Field Quality Control Samples

QC samples are collected in the field and analyzed to check sampling and analytical precision, accuracy, and representativeness. The following section discusses the types and purposes of field QC samples that will be collected for this project. [Table C.2-3](#) provides a summary of the types and frequency of collection of field QC samples. Field QC samples for this project will include MS/MSD samples, equipment rinsates, and source blank samples. Field duplicate samples will not be collected for the confirmation samples due to the heterogeneity soils. In addition, the confirmation samples will be collected at a discrete depth (zero to 6 inches) wherein a duplicate cannot be collected unless another sample is collected adjacent to the original sample. This would not represent a true field duplicate sample. Trip blanks will also not be collected for this project, as they are only applicable to water samples, and the water samples collected for this project are only for waste characterization purposes. Field QC samples are not applicable to the collection of waste characterization samples.

2.5.1.1 Matrix Spike and Matrix Spike Duplicates

MS/MSD samples require the collection of an additional volume of material for laboratory spiking and analysis. MS/MSD samples will be collected at a frequency of 5 percent. MS samples measure the efficiency of all the steps in the analytical method in recovering target analytes from an environmental matrix. The percent recoveries will be calculated for each of the spiked analytes and used to evaluate analytical accuracy. The relative percent difference (RPD) between spiked samples will be calculated to evaluate precision. Project-specific precision and accuracy goals are presented in [Attachment A](#).

2.5.1.2 Equipment Rinsate Samples

Equipment rinsate samples demonstrate whether decontamination procedures are effective in removing contaminants from the field sampling equipment. The presence of contamination in equipment rinsate samples indicates that cleaning procedures were not effective, allowing for the possibility of cross-contamination. Equipment rinsate samples will be collected at a frequency of once per sampling day per sampling equipment. An equipment rinsate is a sample collected after a sampling device is subjected to standard decontamination procedures. Water will be poured over or through the sampling equipment into a sample container and sent to the laboratory for analysis. Analytically certified, organic-free, high-performance liquid chromatography (HPLC)-

grade water or equivalent will be used for organic parameters; deionized or distilled water will be used for inorganic parameters.

Equipment rinsate samples will be sent blind to the laboratory. During data validation, the results for the equipment rinsate samples will be used to qualify data or to evaluate the levels of analytes in the field samples collected on the same day.

2.5.1.3 Source Blank Samples

Source-water blanks will be used to assess the potential for sample contamination from the source water. One source-water blank from each water source will be collected and analyzed for the target analytes.

2.5.2 Laboratory Quality Control Samples

Laboratory QC samples are prepared and analyzed at the laboratory to evaluate the effectiveness of sample preparation and analysis and to assess analytical precision and accuracy. The types of laboratory QC samples that will be used for this project are discussed in the following sections. [Table C.1-3](#) presents the required frequencies for laboratory QC samples, and [Attachment A](#) presents project-specific precision and accuracy goals for these samples.

2.5.2.1 Method Blanks

Method blanks are prepared to evaluate whether contamination is originating from the reagents used in sample handling, preparation, or analysis. They are critical in distinguishing between low-level field contamination and laboratory contamination. A method blank consists of laboratory analyte-free water and all of the reagents used in the analytical procedure. It is prepared for every analysis in the same manner as a field sample and is processed through all of the analytical steps. Method blanks will be prepared at the frequency prescribed in the individual analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method.

2.5.2.2 Laboratory Control Samples or Blank Spikes

A laboratory control sample (LCS), or blank spike, originates in the laboratory as deionized or distilled water that has been spiked with standard reference materials of a known concentration. A LCS is analyzed to verify the accuracy of the calibration standards. These internal QC samples are also used to evaluate laboratory accuracy in the presence of matrix interference for field samples. LCSs are processed through the same analytical procedure as field samples. LCSs will be analyzed at the frequency prescribed in the analytical method or at a rate of 5 percent of the total samples if a frequency is not prescribed in the method. If percent recovery results for the LCS or blank spike are outside of the established goals, laboratory-specific protocols will be followed to gauge the usability of the data.

2.5.2.3 Surrogate Standards

Surrogates are chemical compounds with properties that mimic analytes of interest, but that are unlikely to be found in environmental samples. Surrogates will be added to all field and QC samples analyzed for organic compounds. The surrogate standard measures the efficiency the analytical method in recovering the target analytes from an environmental sample matrix. Percent recoveries for surrogate compounds are evaluated using laboratory control limits. Surrogate standards provide an indication of laboratory accuracy and matrix effects for every field and QC sample that is analyzed for volatile and extractable organic constituents. Surrogate compounds are used in the analysis of VOCs to monitor purge efficiency and analytical performance, whereas surrogates are used in the analysis of extractable organic compounds to monitor the extraction process and analytical performance.

Factors such as matrix interference and high concentrations of analytes may affect surrogate recoveries. The effects of the sample matrix are frequently outside the control of the laboratory and may present unique problems. Laboratory personnel are required to re-extract (when applicable) and re-analyze samples when associated surrogates are outside of control limits. Data from both analyses of the samples in question are reported.

During validation, data will be qualified as estimated for any result that fails to meet surrogate criteria. SVOC data will be qualified as estimated if two or more surrogates from each fraction (base/neutral and acid) are outside the control limits. The tables in [Attachment A](#) provide the guidelines for surrogate recovery for analyses that are planned for this project.

2.5.2.4 Internal Standards

Similarly to the surrogate standard, the internal standard is a chemical compound unlikely to be found in environmental samples that is added to each field and QC sample as a reference compound for sample quantification. Internal standard procedures are used for the analysis of volatile organics and extractable organics using gas chromatography/mass spectrometry (GC/MS) and also can be used for other GC and HPLC analytical methods. The purpose of applying internal standard analysis is to quantify target compounds and ensure that the analytical instrumentation sensitivity and response are stable during the analytical run. An internal standard is used to evaluate the efficiency of the sample introduction process and monitors the efficiency of the analytical procedure for each sample matrix encountered. Internal standards are also used in the analysis of organic compounds by GC to monitor retention-time shifts. Validation of internal standards data will be based on EPA protocols presented in guidelines for evaluating organic analyses (EPA, 1999b).

2.6 EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

This section outlines the testing, inspection, and maintenance procedures that will be used to keep both field and laboratory equipment in good working condition.

2.6.1 Maintenance of Field Equipment

Preventive maintenance for most field equipment is carried out in accordance with procedures and schedules recommended in the equipment manufacturer's literature or operating manual. However, more stringent testing, inspection, and maintenance procedures and schedules will be required when field equipment is used to make critical measurements.

A field instrument that is out of order will be segregated, clearly marked, and not used until it is repaired. The FTL will be notified of equipment malfunctions so that prompt service can be completed quickly or substitute equipment can be obtained. When equipment condition is suspect, unscheduled testing, inspection, and maintenance will be conducted. Any significant problems with field equipment will be reported in the daily field QC report.

2.6.2 Maintenance of Laboratory Equipment

Subcontractor laboratories will prepare and follow a maintenance schedule for each instrument used to analyze samples collected from Moffett. All instruments will be serviced at scheduled intervals necessary to optimize factory specifications. Routine preventive maintenance and major repairs will be documented in a maintenance logbook.

An inventory of items to be kept ready for use in case of instrument failure will be maintained and restocked as needed. The list will identify equipment parts subject to frequent failure, parts that have a limited lifetime of optimum performance, and parts that cannot be obtained in a timely manner.

The laboratory's QA plan and written Standard Operating Procedures (SOPs) will describe specific preventive maintenance procedures for equipment maintained by the laboratory. These documents identify the personnel responsible for major, preventive, and daily maintenance procedures, the frequency and type of maintenance performed, and procedures for documenting maintenance activities.

Laboratory equipment malfunctions will require immediate corrective action. Actions will be documented in laboratory logbooks. No other formal documentation is required unless data quality is adversely affected or further corrective action is necessary. On-the-spot corrective actions will be taken as necessary in accordance with the procedures described in the laboratory QA plan and SOPs.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

The following sections discuss calibration procedures that will be followed to ensure the accuracy of measurements made using field and laboratory equipment.

2.7.1 Calibration of Field Equipment

Field equipment will be calibrated at the beginning of the field effort and at prescribed intervals. The calibration frequency depends on the type and stability of equipment, the intended use of the equipment, and the recommendation of the manufacturer. Detailed calibration procedures for field equipment are available from the specific manufacturers' instruction manuals. All calibration information will be recorded in a field logbook or on field forms. A label that specifies the scheduled date of the next calibration will be attached to the field equipment. If this type of identification is not feasible, equipment calibration records will be readily available for reference.

2.7.2 Calibration of Laboratory Equipment

Laboratory equipment calibration procedures and frequencies will follow the requirements in the reference method in [Section 2.4.2](#) of this SAP. Qualified analysts will calibrate laboratory equipment and document the procedures and results in a logbook.

The laboratory will obtain calibration standards from the EPA repository or commercial vendors for both inorganic and organic compounds and analytes. Stock solutions for surrogate parameters and other inorganic mixes will be made from reagent-grade chemicals or as specified in the analytical method. Stock standards will also be used to make intermediate standards that will be used to prepare calibration standards. Special attention will be paid to expiration dating, proper labeling, proper refrigeration, and freedom from contamination. Documentation on receipt, mixing, and use of standards will be recorded in the appropriate laboratory logbook. Logbooks must be permanently bound. Additional specific handling and documentation requirements for the use of standards may be provided in subcontractor laboratory QA plans.

2.8 INSPECTION AND ACCEPTANCE OF SUPPLIES AND CONSUMABLES

The contractor's Project Manager has primary responsibility for identifying the types and quantities of supplies and consumables needed to implement the remedial design and are also responsible for determining acceptance criteria for these items.

Supplies and consumables can be received either at the contractor's office or at the worksite. When supplies are received at an office, the Project Manager or FTL will sort them according to vendor, check packing slips against purchase orders, and inspect the condition of all supplies before they are accepted for use on a project. If an item does not meet the acceptance criteria, deficiencies will be noted on the packing slip and purchase order, and the item will then be returned to the vendor for replacement or repair.

Procedures for receiving supplies and consumables in the field are similar. When supplies are received, the contractor's Project Manager or FTL will inspect all items against the acceptance

criteria. Any deficiencies or problems will be noted in the field logbook, and deficient items will be returned for immediate replacement.

Analytical laboratories are required to provide certified clean containers for all analyses. These containers must meet EPA standards described in *Specifications and Guidance for Obtaining Contaminant-Free Sampling Containers* (EPA, 1992).

2.9 DATA MANAGEMENT

Field and analytical data collected are critical to the implementation of the remedial action. An information management system is necessary to ensure efficient access so that decisions based on the data can be made in a timely manner.

After the field and laboratory data reports are reviewed and validated, the data will be entered into the contractor's database for Moffett. The database contains data for (1) summarizing observations on contamination and geologic conditions, (2) preparing reports and graphics, and (3) transmitting in an electronic format compatible with the Naval Electronic Data Deliverable (NEDD) standards as described in *Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards* (Southwest Division, Naval Facilities Engineering Command, 2005). The following sections describe data tracking procedures, data pathways, and overall data management.

2.9.1 Data-tracking Procedures

All data that are generated in support of this Navy project are to be tracked through a database created by the contractor. Information related to the receipt and delivery of samples, project order fulfillment, and invoicing for laboratory and validation tasks is stored in this database.

2.9.2 Data Pathways

Data are generated from three primary pathways - data derived from field activities, laboratory analytical data, and validated data. Data from all three pathways must be entered into the database. To evaluate whether the data have been accurately loaded into the database in a timely manner, data pathways must be established and well documented.

Data generated during field activities will be recorded on the contractor's field forms. These forms are reviewed for completeness and accuracy by contractor's FTL. Data from the field forms, including the COC record, are entered into database.

Data generated during laboratory analysis are recorded in hard copy and in electronic data deliverable (EDDs) after the samples have been analyzed. The laboratory will send the hard copy and EDD records to the Project Chemist. The Project Chemist reviews the data deliverable for completeness, accuracy, and format. After the format has been approved, the electronic data are

manipulated and downloaded into the database. The contractor's data entry personnel will then update the database with the total number of samples received and number of days required to receive the data.

After validation, the Project Chemist reviews the data for accuracy. The contractor will then update the database with the appropriate data qualifiers. The associated laboratory and data validation costs are also updated.

2.9.3 Data Management Strategy

The contractor's short- and mid-term data management strategies require that the database be updated per each data delivery. The data consist of chemical and field data entered into a Microsoft Access[®] database. The database can be used to generate reports. All electronic data from this database will be transmitted in a format compatible with NEDD.

To satisfy long-term data management goals, the data will be loaded into the database for storage, further manipulation, and retrieval after the off-site laboratory and field reports are reviewed and validated. The database will be used to provide data for chemical and geologic analysis and for preparing reports and tabular and/or graphic representations of the data. Additional data acquired from field activities are recorded on field forms that are reviewed for completeness and accuracy by the FTL. Hard copies of forms, data, and COC records are filed in a secure storage area according to project number. Laboratory data packages and reports will be archived by the contractor. Laboratories that generated the data will archive hard-copy data for a minimum of 7 years.

3.0 ASSESSMENT AND OVERSIGHT

This section describes the field and laboratory assessments that may be conducted during this project, the individuals responsible for conducting assessments, corrective actions that may be implemented in response to assessment results, and how quality-related issues will be reported to the contractor and Navy management.

3.1 ASSESSMENT AND RESPONSE ACTIONS

Environmental data collection will be overseen by the assessment and audit activities described below. Any problems encountered during an assessment of field investigation or laboratory activities will require appropriate corrective action to ensure that the problems are resolved. This section describes field and laboratory assessments that may be completed and corrective action procedures to address problems identified during an assessment.

3.1.1 Field Assessments

The contractor can schedule field assessments at any time to support data quality and encourage continuous improvement in the systems that support environmental data collection. The contractor's procedures for conducting field assessments will be documented using a checklist developed for the project.

Technical systems audits (TSAs) are a type of field assessment that will be frequently conducted by the contractor. Contractor personnel conducting TSAs use personnel interviews, direct observations, and reviews of project-specific documentation to evaluate and document whether procedures specified in the approved Sampling and Analysis Plan (SAP) are being implemented. The following specific items may be observed during the TSA:

- Availability of project plans such as the SAP and Health and Safety Plan
- Documentation of personnel qualifications and training
- Sample collection, identification, preservation, handling, and shipping procedures
- Sampling equipment decontamination
- Equipment calibration and maintenance
- Completeness of logbooks and other field records (including nonconformance documentation)
- Health and safety procedures

During the TSA, the contractor's lead assessor verbally communicates any significant deficiencies to the field team leader (FTL) for immediate correction. These and all other observations and comments are documented in a draft TSA report. The draft TSA report is issued

to the contractor's Project Manager, the contractor's engineer lead, and FTL in electronic (e-mail) format within 7 days after the TSA is completed. Project teams are required to respond to the draft report within 3 days, and a final TSA report is issued within 7 days after the project team responds.

The Navy Quality Assurance (QA) Officer may also independently conduct a field assessment of the project. Items reviewed by the Navy QA Officer during a field assessment would be similar to those described above.

3.1.2 Laboratory Assessments

The laboratory selected to perform the analyses must have successfully completed the NFESC laboratory evaluation process and must maintain that status throughout the project. To determine the status of the laboratory, a laboratory QA plan review, performance evaluation sample analysis, and data package review may be conducted. The contractor will not perform on-site audits or visits unless deemed necessary by the Navy.

The contractor's laboratory oversight will consist of monitoring laboratory performance and reviewing the preliminary report and hard-copy data packages. The information that will be obtained from the data packages consists of the following:

- Correctness of COC procedures
- Adherence to method or SAP holding times
- Adequacy of method detection limits and reporting limits
- Correctness of spiking levels, frequency, and recovery
- Accuracy of analytical operations based on the LCS

Oversight findings will be included in the QC Summary Report (QCSR) for the project (see [Section 3.2.3](#)).

3.1.3 Field Corrective Action Procedures

Field corrective action procedures will depend on the type and severity of the finding. The contractor will classify assessment findings as either deficiencies or observations. Deficiencies are findings that may have a significant impact on data quality and that will require corrective action. Observations are findings that do not directly affect data quality, but are suggestions for consideration and review.

As described in [Section 3.1.1](#), project teams are required to respond to deficiencies identified in TSA reports. The contractor's Project Manager, project lead engineer, FTL, and Project Chemist will meet to discuss the deficiencies and the appropriate steps to resolve each deficiency by:

- Determining when and how the problem developed
- Assigning responsibility for problem investigation and documentation
- Selecting the corrective action to eliminate the problem
- Developing a schedule for completing the corrective action
- Assigning responsibility for implementing the corrective action
- Documenting and verifying that the corrective action has eliminated the problem
- Notifying the Navy of the problem and the corrective action taken

In responding to the TSA report, the project team will include a brief description of each deficiency, the proposed corrective action, the individual responsible for determining and implementing the corrective action, and the completion dates for each corrective action.

The contractor's Program QA Manager is responsible for reviewing proposed corrective actions and verifying that they have been effectively implemented. The Program QA Manager can require data acquisition to be limited or discontinued until the corrective action is complete and a deficiency is eliminated. The Program QA Manager can also request the reanalysis of any or all data acquired since the system was last in control.

3.1.4 Laboratory Corrective Action Procedures

Internal laboratory procedures for corrective action and descriptions of out-of-control situations that require corrective action are contained in laboratory QA plans. At a minimum, corrective action will be implemented when any of the following three conditions occurs: control limits are exceeded, method quality control (QC) requirements are not met, or sample-holding times are exceeded. The laboratory will report out-of-control situations to the contractor's Project Chemist within 2 working days after they are identified. In addition, the laboratory project manager will prepare and submit a corrective action report to the contractor's Project Chemist. This report will identify the out-of-control situation and the steps that the laboratory has taken to rectify it.

3.2 REPORTS TO MANAGEMENT

Effective management of environmental data collection requires (1) timely assessment and review of all activities and (2) open communication, interaction, and feedback among all project participants. The contractor will use the reports described below to address any project-specific quality issues and to facilitate timely communication of these issues.

3.2.1 Daily Progress Reports

The contractor will prepare a daily progress report to summarize activities throughout the field investigation. This report will describe sampling and field measurements, equipment used, contractor and subcontractor personnel on site, QA/QC and health and safety activities, problems

encountered, corrective actions taken, deviations from the SAP, and explanations for the deviations. The daily progress report is prepared by the FTL and submitted to the Project Manager and to the Navy Remedial Project Manager (RPM), if requested. The content of the daily reports will be summarized and included in the final report submitted for the field investigation.

3.2.2 Project Monthly Status Report

The contractor's Project Manager will prepare a monthly status report (MSR) to be submitted to the Navy RPM. Monthly status reports address project-specific quality issues and facilitate their timely communication. The MSR will provide the following quality-related information:

- Project status
- Instrument, equipment, or procedural problems that affect quality and recommended solutions
- Objectives from the previous report that were achieved
- Objectives from the previous report that were not achieved
- Work planned for the next month

If appropriate, the contractor will obtain similar information from subcontractors participating in the project and will incorporate the information within the MSR.

3.2.3 Quality Control Summary Report

The contractor will prepare a QCSR that will be submitted to the Navy RPM with the final report for the field investigation. Data collected during the field efforts will be reconciled with the project data quality objectives by preparing summary tables, charts, figures, or performing other types of data analyses that facilitate direct comparison of data collected through the entire extent of the project. Comparisons will be made on a parameter-specific basis, concentrating on the contaminants of concern. Comparisons also will facilitate an analysis of contaminant concentration trends through time and space.

4.0 DATA VALIDATION AND USABILITY

This section describes the procedures that are planned to review, verify, and validate field and laboratory data. This section also discusses procedures for verifying that the data are sufficient to meet data quality objectives (DQOs) for the project.

4.1 DATA REVIEW, VERIFICATION, AND VALIDATION

Validation and verification of the data generated during field and laboratory activities are essential to obtaining data of defensible and acceptable quality. Verification and validation methods for field and laboratory activities are presented below.

4.1.1 Field Data Verification

Project team personnel will verify field data through reviews of data sets to identify inconsistencies or anomalous values. Any inconsistencies discovered will be resolved as soon as possible by seeking clarification from field personnel responsible for data collection. All field personnel will be responsible for following the sampling and documentation procedures described in this Sampling and Analysis Plan (SAP) so that defensible and justifiable data are obtained.

Data values that are significantly different from the population are called “outliers.” A systematic effort will be made to identify any outliers or errors before field personnel report the data. Outliers can result from improper sampling or measurement methodology, data transcription errors, calculation errors, or natural causes. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in sampling, measurement, transcription, or calculation will be clearly identified in project reports.

4.1.2 Laboratory Data Verification

Laboratory personnel will verify analytical data at the time of analysis and reporting and through subsequent reviews of the raw data for any non-conformances to the requirements of the analytical method. Laboratory personnel will make a systematic effort to identify any outliers or errors before they report the data. Outliers that result from errors found during data verification will be identified and corrected; outliers that cannot be attributed to errors in analysis, transcription, or calculation will be clearly identified in the case narrative section of the analytical data package.

4.1.3 Laboratory Data Validation

An independent third-party contractor will validate all laboratory data in accordance with current U.S. Environmental Protection Agency (EPA) national functional guidelines (EPA, 2004b;

1999b). The data validation strategy will be consistent with Navy guidelines including *Environmental Work Instruction (EWI) #1, 3EN2.1, Chemical Data Validation* (Southwest Division, Naval Facilities Engineering Command, 2001b). For this project, 80 percent of the data will undergo cursory validation and 20 percent of the data will undergo full validation. Requirements for cursory and full validation are listed below.

4.1.3.1 Cursorsy Data Validation

Cursory validation will be completed for 80 percent of the summary data packages for analysis of confirmation samples and import fill samples. The data reviewer is required to notify the contractor and request any missing information needed from the laboratory. Elimination of the data from the review process is not allowed. All data will be qualified as necessary in accordance with established criteria. The content of the data summary packages is described in [Section 1.6.2](#) and [Table C.1-5A](#).

4.1.3.2 Full Data Validation

Full validation will be completed for 20 percent of the full data packages for analysis of confirmation samples and import fill samples. The data reviewer is required to notify the contractor and request any missing information needed from the laboratory. Elimination of data from the review process is not allowed. All data will continue through the validation process and will be qualified in accordance with established criteria. The content of the full data packages is described in [Section 1.6.3](#) and [Table C.1-5B](#).

4.1.3.3 Data Validation Criteria

[Table C.4-1](#) lists the QC criteria that will be reviewed for both cursory and full data validation. The data validation criteria selected from [Table C.4-1](#) will be consistent with the project-specific analytical methods listed in [Section 2.4.2](#).

4.2 RECONCILIATION WITH USER REQUIREMENTS

After environmental data have been reviewed, verified, and validated in accordance with the procedures described in [Section 4.1](#), the data must be further evaluated to determine whether DQOs have been met.

To the extent possible, the contractor will follow EPA's data quality assessment (DQA) process to verify that the type, quality, and quantity of data collected are appropriate for their intended use. DQA methods and procedures are outlined in EPA's *Guidance for Data Quality Assessment, Practical Methods for Data Analysis* (EPA, 2000b). The DQA process consists of five steps: (1) review the DQOs and sampling design; (2) conduct a preliminary data review; (3) select a statistical test; (4) verify the assumptions of the statistical test; and (5) draw conclusions from the data.

When the five-step DQA process is not completely followed because the DQOs are qualitative in nature, the contractor will systematically assess data quality and data usability. This assessment will consist of:

- A review of the sampling design and sampling methods to verify that these were implemented as planned and are adequate to support project objectives.
- A review of project-specific data quality indicators for precision, accuracy, representativeness, completeness, comparability, and quantitation limits (defined in [Section 1.3.2](#)) to determine whether acceptance criteria have been met.
- A review of project-specific DQOs to determine whether they have been achieved by the data collected.
- An evaluation of any limitations associated with the decisions to be made based on the data collected. For example, if data completeness is only 90 percent compared to a project-specific completeness objective of 95 percent, the data may still be usable to support a decision, but at a lower level of confidence.

The Quality Control Summary Report (see [Section 3.2.3](#)) and final report for the project will discuss any potential impacts of these reviews on data usability and will clearly define any limitations associated with the data.

5.0 REFERENCES

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TABLES

TABLE C.1-1**IMPLEMENTATION SCHEDULE FOR SAMPLING, ANALYSIS, AND REPORTING**

Task	Start Date	End Date	Duration^a
Pre-Draft SAP Preparation	March 14, 2005	July 15, 2005	109
Navy review of Pre-Draft	July 18, 2005	August 8, 2005	22
Prepare Pre-Draft RTCs	August 8, 2005	August 14, 2005	7
Incorporate RTCs and Issue Draft	August 15, 2005	August 28, 2005	14
Regulatory review of Draft	August 29, 2005	October 28, 2005	60
Prepare Draft RTCs	October 29, 2005	November 18, 2005	21
Incorporate RTCs and Issue Draft Final	November 19, 2005	January 4, 2006	14
Navy/Regulatory review of Draft Final	January 5, 2006	February 5, 2006	30
Prepare Draft Final RTCs	February 5, 2006	February 12, 2006	7
Incorporate RTCs and Issue Final	February 12, 2006	February 24, 2006	12
Implementation of Remedial Design^b			
Mobilization	March 2006		
Field activities including sampling, analysis, and reporting	March 2006	September 2006	

Notes

^a – Duration in calendar days.

^b – Approximate dates; a detailed sampling schedule, including actual dates and durations, will be provided by the selected contractor after project is awarded.

SAP – Sampling and Analysis Plan

RTC – Response to Comments

TABLE C.1-2
DATA QUALITY OBJECTIVES

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
Statement of Problem	Decisions	Inputs to the Decisions	Boundaries of the Study	Decision Rules	Limits on Decision Errors	Optimize the Sampling Design
<p>Based on extensive environmental investigations conducted from 1995 to 2002 to evaluate the ecology and nature and extent of contamination, the Navy determined that chemicals including PCBs, pesticides, and metals in sediment samples from the Northern Channel and associated areas, known as Site 27, at the former Naval Air Station Moffett Field are at levels that require cleanup.</p> <p>The primary objective of this project is to develop the remedial design documents for implementation of the proposed remedial actions for Site 27. The Navy proposes to clean up contaminated sediments and soils by:</p> <ul style="list-style-type: none">Collecting in situ sediment/soil samples from within the Northern Channel, Marriage Road Ditch, North Patrol Road Ditch, north and south slopes of the western portion of the Northern Channel for chemical testing for waste characterization purposes.Collecting samples from the debris stockpile for chemical testing for waste characterization purposes.Removing a layer of sediments and soils, and debris pile considered to be hazardous to the ecological receptors.Transporting excavated sediments, soils, and debris to an appropriate off-site facility for disposal.Conducting confirmation sampling of sediments and surface soils after excavation of the area to ensure that cleanup goals have been achieved.Collecting runoff water from sediment drying pads in detention/settling basin, pumped through the on-site treatment system, and then pumped to Baker tanks. Baker tanks to be sampled, then water to be discharged to Northern Channel depending on analytical results.Re-establishing the water flow through the drainage channels, revegetating the disturbed areas, and improving the local habitat environment.Collecting and analyzing import material samples prior to backfilling. <p>In addition, a bench-scale test is needed in order to find the filter types that optimize the on-site treatment system configuration to meet the discharge requirement for turbidity. A summary of bench-scale design is described in section 2.15.</p>	<p>1. Are the filters selected in the remedial design adequate to bring the turbidity of wastewater to discharge limit described in section 2.1.5?</p> <p>2. Are the analytical results from the in situ and debris pile samples below the IDW, 10x STLC, and 20x TCLP limits in Table B-1 (Attachment B)?</p> <p>3. Are the analytical results from the confirmation sampling at Site 27 above the RAOs as listed in Table B-1 (Attachment B)?</p> <p>4. Are the analytical results from the wastewater above the discharge requirements in Table B-1 (Attachment B)?</p> <p>5. Are the analytical results for the import material above the action levels listed in Table B-1 (Attachment B)?</p>	<p>1. Results from the bench-scale test that simulates the on-site treatment system design.</p> <p>2. Results of the in situ and debris pile samples.</p> <p>3. Results of confirmation soil samples.</p> <p>4. Results of the wastewater samples.</p> <p>5. Results of the import material samples.</p>	<p>Figure C.1-2 of the SAP illustrates the proposed excavation area.</p> <p>Project duration is anticipated to be from April through October 2006.</p> <p>1. One sediment and water mixture sample will be collected from the channel prior to start of excavation activities in accordance with procedures in 2.2.5.</p> <p>2. In situ samples will be collected every 50 linear feet, as described in Section 2.0 of the SAP. One debris pile sample will be collected for every 500 cubic yards. Samples will be analyzed for the COPECs. Ten percent of the samples collected will be analyzed for additional disposal facility requirements.</p> <p>3. Confirmation soil samples will be collected from each 50-foot linear section at zero to 6 inches bgs from the Northern Channel,, ditches and along the slopes. Confirmation soil samples will be collected at zero to 6 inches from each 50-foot by 50-foot grid at the debris pile area. Samples will be analyzed for COPECs.</p> <p>4. One sample will be collected each week from the Baker tanks for waste characterization and discharge purposes. Samples will be analyzed for the site’s discharge requirements (for the Northern Channel).</p> <p>5. Import material samples will be collected at a frequency as described in the DTSC guidance document. Import material samples will be analyzed as described in Section 2.0 of the SAP.</p>	<p>1. If the turbidity results of the first filtrate from the bench-scale test do not meet the discharge requirement, then the treatment system design will be modified. Otherwise, the current on-site treatment system design will be installed.</p> <p>2. If the results are below the IDW, 10x STLC, and 20x TCLP limits, then the waste will be classified as non-hazardous. Otherwise, additional analyses such as STLC or TCLP will be conducted if the concentration is above 10 times the STLC limit for that analyte or 20 times the TCLP limit for any analyte to determine if the waste is California State hazardous (STLC exceedance) or RCRA hazardous (TCLP exceedance) and will be manifested, transported, and disposed of accordingly.</p> <p>3. If the results of confirmation soil and sediment samples collected at Site 27 are above the RAOs for sediments and soil, then the entire area in question will be over-excavated and resampled at every 6 inches to maximum of 2 feet. Otherwise, grading activities will commence.</p> <p>4. If the results of the wastewater samples are above the discharge limits, then the wastewater will be pumped through the on-site treatment system once more, and if wastewater does not meet discharge requirement after two treatments, then wastewater will be classified as California state hazardous (STLC) or RCRA hazardous (TCLP) and will be disposed of accordingly. Otherwise, the wastewater will be discharged into the Northern Channel.</p> <p>5. If the results of the import material are above the action levels, then the material will not be used on site. Another import fill source will be identified, and samples will be collected and compared against the action levels. Otherwise, the import material will be used as backfill on site.</p>	<p>To limit decision errors, analytical method requirements and project-specific DQOs were established. Published analytical method and laboratory-specific performance requirements are the primary determiners of DQOs for precision and accuracy.</p> <p>Field crews will review the SAP before collection of samples. The laboratory performing the analysis will be given a copy of the SAP before analysis of samples.</p> <p>Third-party data validation will be performed on all samples, except waste characterization samples.</p> <p>Sampling and analysis protocols will be carefully followed to limit errors.</p>	<p>1. Bench-scale test and system design will be conducted and modified until turbidity results meets the discharge requirements described in Section 2.1.5.</p> <p>2. In situ sampling, as described in Step 4, was designed to characterize the sediment/soil in place thereby facilitating the segregation of the material during excavation.</p> <p>3. Confirmation soil samples will be collected from zero to 6, inches as described in Step 4. Each sample will be collected from a random location every 50 linear feet along the Northern Channel, ditches, and slopes and within each 50-foot by 50-foot grid at the debris stockpile area.</p> <p>4. Once a week, wastewater will be collected from the Baker tanks, as described in Step 4.</p> <p>5. Import material samples will be collected and analyzed, as described in Step 4.</p>

Notes

- bgs – below ground surface
COPEC – chemical of potential ecological concern
DQO – data quality objective
DTSC – Department of Toxic Substances Control
IDW – investigation-derived waste
PCB – polychlorinated biphenyl
RAO – Remedial Action Objective
RCRA – Resource Conservation and Recovery Act
SAP – Sampling and Analysis Plan
STLC – Soluble Threshold Limit Concentration
TCLP – Toxicity Characteristic Leaching Procedure

TABLE C.1-3**QUALITY CONTROL SAMPLES FOR PRECISION AND ACCURACY**

QC Type	Precision	Accuracy	Frequency
Field QC	MS/MSD RPD	Equipment Rinsate Source Blank	Equipment Rinsate = 1/day/piece of equipment Source Blank = 1/source water
Laboratory QC	MS/MSD RPD	MS/MSD %R Method Blanks LCS or Blank Spikes Surrogate Standards %R Internal Standards %R	MS/MSD = 1/20 samples Method Blank = 1/20 samples LCS or Blank Spikes = 1/20 samples Surrogate = every sample Internal Standard = every sample

Notes:

%R – percent recovery

LCS – laboratory control spike

MS/MSD – matrix spike/matrix spike duplicate

QC – quality control

RPD – relative percent difference

TABLE C.1-4
KEY PERSONNEL

Name	Organization	Role	Responsibilities	Contact Information
Scott Gromko	Navy	Remedial Project Manager	Responsible for overall project execution and for coordination with base representatives, regulatory agencies, and Navy management Actively participates in DQO process Provides management and technical oversight during data collection	BRAC Project Management Office West 1455 Frazee Road, Suite 900 San Diego, CA 92108 (619) 532-0933
Narciso A. Ancog	Navy	QA Officer	Responsible for QA issues for all Navy work Provides government oversight of selected contractor's QA program Reviews and approves SAP and any significant modifications Has authority to suspend project activities if Navy quality requirements are not met	NAVFAC SW 1220 Pacific Highway San Diego, CA 92132-5190 (619) 532-3046
Abram Eloskof	Tetra Tech EC, Inc.	Project Manager	Responsible for implementing all activities Monitors and directs field activities to ensure compliance with SAP requirements	TBD
Mary Schneider	Tetra Tech EC, Inc.	QC Program Manager	Responsible for resolution of QA issues with Navy QA officer Provides program-level QA guidance to installation coordinator, Project Manager and project team. Identifies nonconformances through QA review activities and recommends corrective action	TBD
Lynn Jefferson/Jon Karnath	Tetra Tech EC, Inc.	Project Chemist/ Database Manager	May conduct laboratory evaluations Coordinates with laboratory project manager on analytical requirements, delivery schedules, and logistics Coordinates independent validation of laboratory data Reviews laboratory data and validation reports before release to project team Prepares and supports report preparation Responsible for developing, monitoring, and maintaining project database under guidance of Project Manager	TBD

TABLE C.1-4
KEY PERSONNEL

Name	Organization	Role	Responsibilities	Contact Information
TBD	TBD	Field Team Leader	Responsible for directing day-to-day field activities conducted by selected contractor and subcontractor personnel Verifies that field sampling and measurement procedures follow SAP Provides Project Manager with regular reports on status of field activities	TBD
TBD	TBD	On-site Health and Safety Officer	Responsible for implementing Health and Safety Plan and for determining appropriate site control measures and personal protection levels Conducts safety briefings for selected contractor and subcontractor personnel and site visitors Can suspend operations that threaten health and safety	TBD
TBD	Laboratory	Laboratory Project Manager	Responsible for delivering analytical services that meet SAP requirements Reviews SAP to understand analytical requirements Works with project chemist to confirm sample delivery schedules Reviews laboratory data package before delivery	TBD

Notes

BRAC – Base Realignment and Closure
DQO – data quality objective
NAVFAC SW – Naval Facilities Engineering Command, Southwest
QA – quality assurance
SAP – Sampling and Analysis Plan
TBD – to be determined

TABLE C.1-5A

REQUIREMENTS FOR SUMMARY DATA PACKAGES

Requirements for Summary Data Packages - Organic Analysis	Requirements for Summary Data Packages - Inorganic Analysis
<p><u>Section I Case Narrative</u></p> <ol style="list-style-type: none"> 1. Case narrative 2. Copies of nonconformance and corrective action forms 3. Chain-of-custody records 4. Copies of sample receipt notices 5. Internal tracking documents, as applicable <p><u>Section II Sample Results - Form I for the following:</u></p> <ol style="list-style-type: none"> 1. Environmental samples <p><u>Section III QA/QC Summaries - Forms II through XI for the following:</u></p> <ol style="list-style-type: none"> 1. System monitoring compound and surrogate recoveries (Form II) 2. MS and MSD recoveries and RPDs (Forms I and III) 3. Blank spike or LCS recoveries (Forms I and III-Z) 4. Method blanks (Forms I and IV) 5. Performance check (Form V) 6. Initial calibrations with retention time information (Form VI) 7. Continuing calibrations with retention time information (Form VII) 8. Internal standard areas and retention times (Form VIII) 9. Analytical sequence (Forms VIII-D and VIII-Z) 10. Matrix-specific method detection limit (Form XI-Z) 	<p><u>Section I Case Narrative</u></p> <ol style="list-style-type: none"> 1. Case narrative 2. Copies of nonconformance and corrective action forms 3. Chain-of-custody records 4. Copies of sample receipt notices 5. Internal tracking documents, as applicable <p><u>Section II Sample Results - Form I for the following:</u></p> <ol style="list-style-type: none"> 1. Environmental samples <p><u>Section III QA/QC Summaries - Form II through VI for the following:</u></p> <ol style="list-style-type: none"> 1. Initial and continuing calibration verifications (Form II) 2. PRRL standard (Form II) 3. Detection limit standard (Form II-Z) 4. Method blanks, continuing calibration blanks, and preparation blanks (Form III) 5. ICP interference-check samples (Form IV) 6. MS and post-digestion spikes (Forms V and V-Z) 7. Sample duplicates (Form VI) 8. LCSs (Form VII) 9. Method of standard additions (Form VIII) 10. ICP serial dilution (Form IX) 11. IDL (Form X) 12. ICP interelement correction factors (Form XI) 13. ICP linear working range (Form XII)

Notes:

ICP – inductively coupled plasma
IDL – instrument detection limit
LCS – laboratory control spike
MS – matrix sample
MSD – matrix sample duplicate
PRRL – project-required reporting limit
QA – quality assurance
QC – quality control

RPD – relative percent difference
SVOC – semivolatile organic compound
TIC – tentatively identified compounds
VOC – volatile organic compound

TABLE C.1-5B**REQUIREMENTS FOR FULL DATA PACKAGES**

Requirements for Full Data Packages – Organic Analysis	Requirements for Full Data Packages – Inorganic Analysis
<u>Sections I, II, and III</u> Summary Package	<u>Sections I, II, III</u> Summary Package
<u>Section IV</u> Sample Raw Data - Indicated form, plus all raw data	<u>Section IV</u> Instrument Raw Data - Sequential measurement readout records for ICP, graphite furnace atomic absorption, flame atomic absorption, cold vapor mercury, cyanide, and other inorganic analyses, which will contain the following information:
1. Analytical results, including dilutions and reanalysis (Forms I and X)	1. Environmental samples, including dilutions and analysis
	2. Initial calibration
<u>Section V</u> QC Raw Data - indicated form, plus all raw data	3. Initial and continuing calibration verifications
1. Method blanks (Form I)	4. Detection limit standards
2. MS and MSD samples (Form I)	5. Method blanks, continuing calibration blanks, and preparation blanks
3. Blank spikes or LCSs (Form I)	6. ICP interference check samples
<u>Section VI</u> Standard Raw Data - Indicated form, plus all raw data	7. MS and post-digestion spikes
1. Performance check (Form V)	8. Sample duplicates
2. Initial calibrations, with retention-time information (Form VI)	9. LCSs
3. Continuing calibrations, with retention-time information (Form VII)	10. Method of standard additions
4. GPC calibration (Form IX)	11. ICP serial dilution
<u>Section VII</u> Other Raw Data	<u>Section V</u> Other Raw Data
1. Percent moisture for soil samples	1. Percent moisture for soil samples
2. Sample extraction and cleanup logs	2. Sample digestion, distillation, and preparation logs, as necessary
3. Instrument analysis log for each instrument used (Form VIII-Z)	3. Instrument analysis log for each instrument used
4. Standard preparation logs, including initial and final concentrations for each standard used	4. Standard preparation logs, including initial and final concentrations for each standard used
5. Formula and a sample calculation for the initial calibration	5. Formula and a sample calculation for the initial calibration
6. Formula and a sample calculation for soil sample results	6. Formula and a sample calculation for soil sample results

Notes

GPC – gel permeation cleanup
ICP – inductively coupled plasma
LCS – laboratory control spike
MS – matrix spike
MSD – matrix spike duplicate

QC – quality control
SVOA – semivolatile organic analysis
TIC – tentatively identified compounds
VOA – volatile organic analysis

TABLE C.2-1**SUMMARY OF FIELD AND QC SAMPLE ANALYSIS**

Event	Parameter	Analytical Method	Matrix	Field Samples	Equipment Rinsate^a	Source Blank	Total Number of Samples	MS/MSD (at 5%)^b
Confirmation sampling of Northern Channel and ditches	Title 22 metals, PCBs, pesticides	SW-846 6010B/7000, 8082, 8081A	Solid	332	20	1	353	18
Confirmation sampling of slopes	Title 22 metals, PCBs, pesticides	SW-846 6010B/7000, 8082, 8081A	Solid	32	5	1	38	2
Confirmation of debris area	Title 22 metals, PCBs, pesticides	SW-846 6010B/7000, 8082, 8081A	Solid	12	1	1	14	1
Import fill material	Title 22 metals, PCBs, pesticides, VOCs, SVOCs, asbestos	SW-846 6010B/7000, 8082, 8081A, 8260B, 8270C, and CARB 435	Solid	TBD	TBD	TBD	TBD	TBD
Discharge Water	Total DDT, Total PCBs, turbidity	SW-846 8082, 8081A, turbidity meter	Liquid	36	N/A	N/A	36	N/A
Total				412	26	3	441	21

Notes:

^aEquipment rinsate samples estimated based on one rinsate collected per day of sampling.

^bMS and MSD are not considered additional samples.

CARB – California Air Resources Board

DDT – dichlorodiphenyltrichloroethane

MS – matrix sample

MSD – matrix sample duplicate

N/A – not applicable

PCB – polychlorinated biphenyl

QC – quality control

SVOC – semivolatile organic compound

TBD – to be determined

VOC – volatile organic compound

TABLE C.2-2

SAMPLE CONTAINER, HOLDING TIME, AND PRESERVATIVE REQUIREMENTS

Parameter	Method Number ^a	Sample Volume	Sample Container	Preservative	Holding Time
Soil/Sediment					
Title 22 metals	SW-846 6010B/7000	1 @ 8-ounce	Plastic or stainless steel liner or glass jar	Cool, 4 ± 2°C	6 months; 28 days for mercury
PCBs	SW-846 8082			Cool, 4 ± 2°C	14 days
Pesticides	SW-846 8081A			Cool, 4 ± 2°C	14 days
SVOCs	SW-846 8270C			Cool, 4 ± 2°C	14 days
VOCs	SW-846 8260B	3 @ 5 gram	En Core samplers ^b	Cool, 4 ± 2°C	48 hours
Turbidity	Measured by bench-scale testing facility	1 @ 5 gallon	Plastic bucket	None	None
Water (for waste characterization only)					
Title 22 metals	SW-846 6010B/7000	1 @ 500-mL	Plastic	To pH < 2 with HCl	6 months; 28 days for mercury
PCBs	SW-846 8082	2 @ 1-L	Glass amber with Teflon [®] -lined septum	Cool, 4 ± 2°C	14 days
Pesticides	SW-846 8081A	2 @ 1-L	Glass amber with Teflon [®] -lined septum	Cool, 4 ± 2°C	14 days
SVOCs	SW-846 8270C	2 @ 1-L	Glass amber with Teflon [®] -lined septum	Cool, 4 ± 2°C	14 days
VOCs	SW-846 8260B	3 @ 40 mL	Glass vial with Teflon [®] -lined septum	To pH < 2 with HCl; Cool, 4 ± 2°C	14 days

Notes:^a Complete method references are presented in Section 2.4^b If En Core samplers are not able to be used due to the type of media (saturated soil or a soil matrix that does not break into small enough pieces to fit into an En Core), then EPA Method 5030B will be used and EPA Method 8260B will be performed from the sample in the liner or jar.

°C – degrees Celsius

EPA – U.S. Environmental Protection Agency

HCl – hydrochloric acid

L – liter

mL – milliliter

PCB – polychlorinated biphenyl

SVOC – semivolatile organic compound

VOC – volatile organic compound

TABLE C.2-3
FIELD QC SAMPLES

QC Sample Type	Frequency of Analysis	QC Sample Matrix
Matrix spike and matrix spike duplicate	5 percent ^a	Soil
Equipment rinsate blank	1 per day per piece of equipment	Water
Source blank	1 per source water	Water

Notes

^a Matrix spike and matrix spike duplicate will be selected by the sampler.

QC – quality control

TABLE C.4-1
DATA VALIDATION CRITERIA

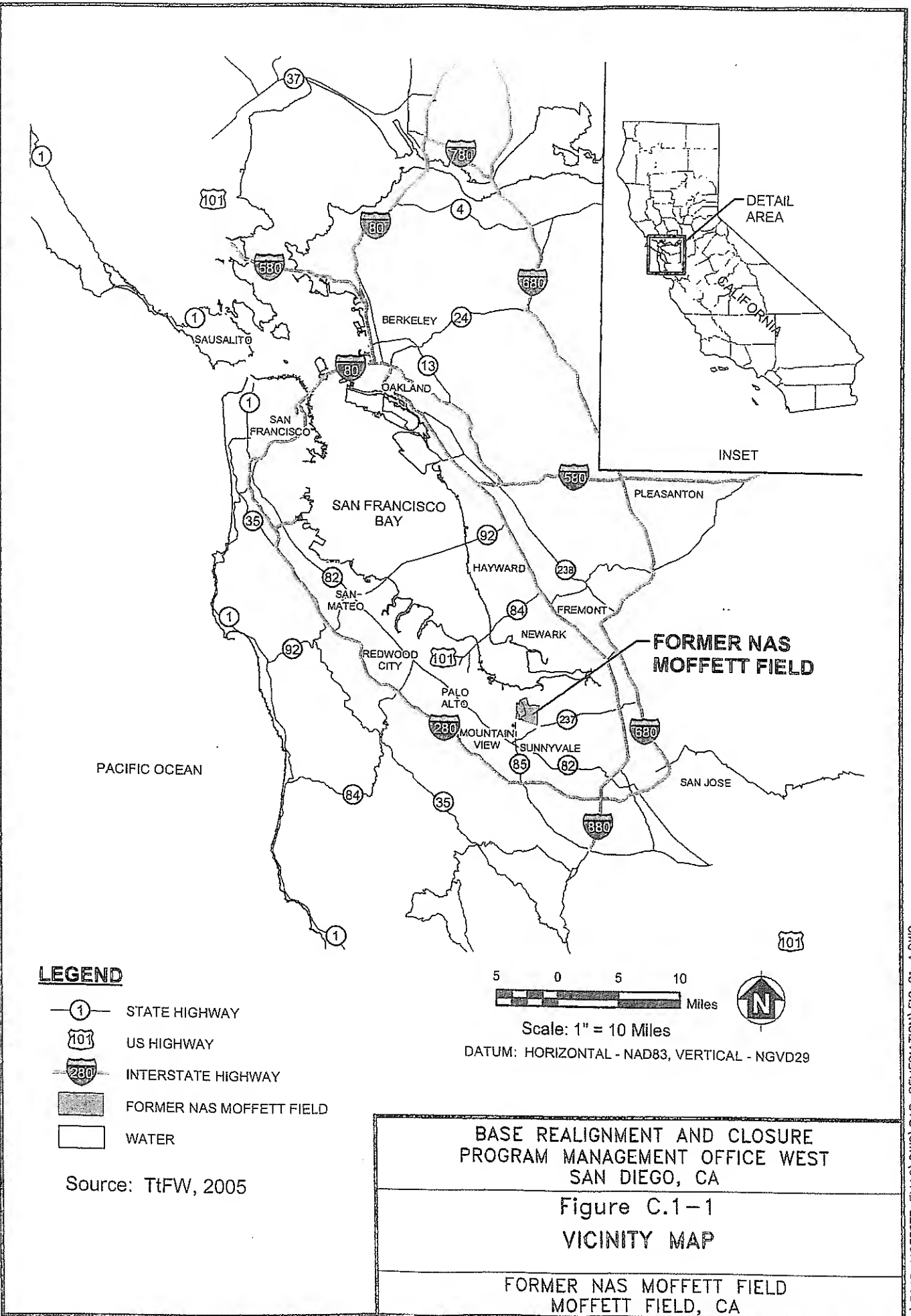
Analytical Parameter Group	Cursory Data Validation Criteria	Full Data Validation Criteria
Organic Analyses	Method compliance Holding times Calibration Blanks Surrogate recovery Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Internal standard performance Other laboratory QC specified by the method Overall assessment of data for an SDG	Method compliance Holding times Calibration Blanks Surrogate recovery Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Internal standard performance Compound identification Detection limits Compound quantitation Sample results verification Other laboratory QC specified by the method Overall assessment of data for an SDG
Inorganic Analyses	Method compliance Holding times Calibration Blanks Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Other laboratory QC specified by the method Overall assessment of data for an SDG	Method compliance Holding times Calibration Blanks Matrix spike and matrix spike duplicate recovery Laboratory control sample or blank spike Compound identification Detection limits Compound quantitation Sample results verification Other laboratory QC specified by the method Overall assessment of data for an SDG

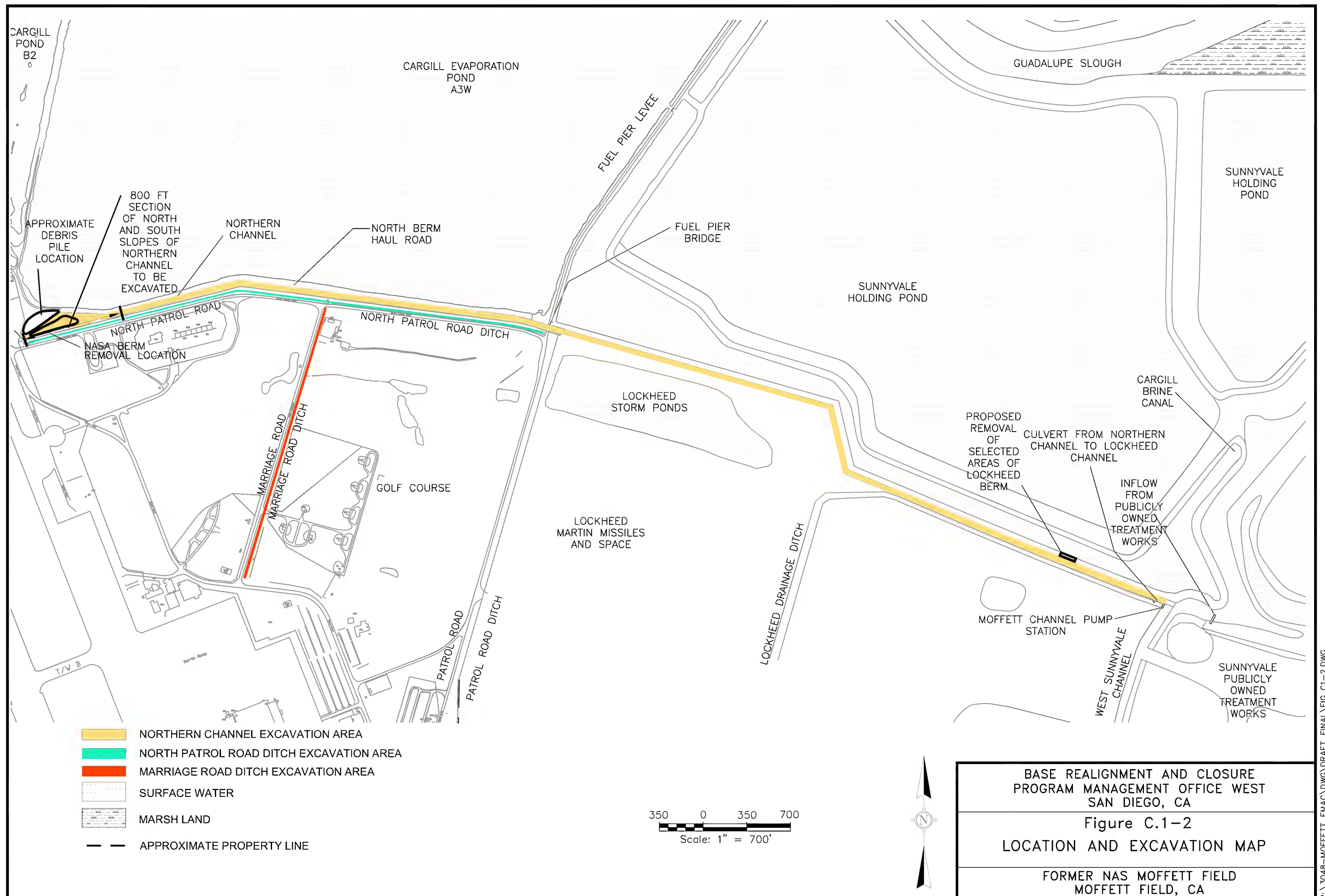
Notes

QC – quality control

SDG – sample delivery group

FIGURES



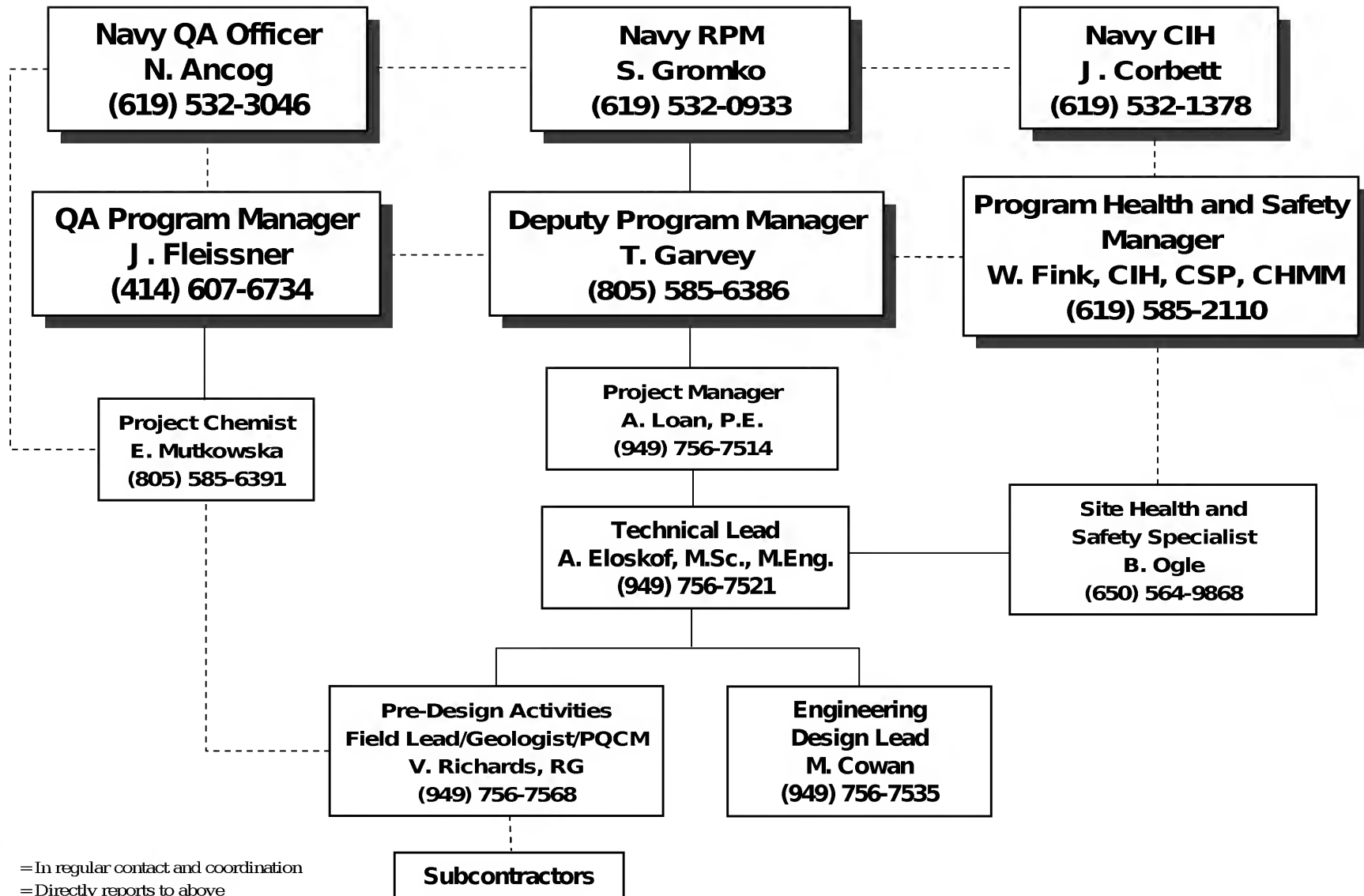


BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
SAN DIEGO, CA

Figure C.1-2
LOCATION AND EXCAVATION MAP

FORMER NAS MOFFETT FIELD
MOFFETT FIELD, CA

FIGURE C.1-3
PROJECT ORGANIZATION CHART



ATTACHMENT A

METHOD PRECISION AND ACCURACY GOALS

TABLE A-1
METHOD PRECISION AND ACCURACY GOALS

Method	Analyte	Accuracy Soil (% R)	Precision Soil (RPD)	Accuracy Water (% R)	Precision Water (RPD)
EPA Method 6010B/7000	Antimony	75-125	≤ 30	75-125	≤ 25
	Arsenic	75-125	≤ 30	75-125	≤ 25
	Barium	75-125	≤ 30	75-125	≤ 25
	Beryllium	75-125	≤ 30	75-125	≤ 25
	Cadmium	75-125	≤ 30	75-125	≤ 25
	Chromium	75-125	≤ 30	75-125	≤ 25
	Cobalt	75-125	≤ 30	75-125	≤ 25
	Copper	75-125	≤ 30	75-125	≤ 25
	Lead	75-125	≤ 30	75-125	≤ 25
	Mercury	75-125	≤ 30	75-125	≤ 25
	Molybdenum	75-125	≤ 30	75-125	≤ 25
	Nickel	75-125	≤ 30	75-125	≤ 25
	Selenium	75-125	≤ 30	75-125	≤ 25
	Silver	75-125	≤ 30	75-125	≤ 25
	Thallium	75-125	≤ 30	75-125	≤ 25
	Vanadium	75-125	≤ 30	75-125	≤ 25
	Zinc	75-125	≤ 30	75-125	≤ 25
EPA Method 8081A	γ-BHC (Lindane)	40-130	≤ 50	50-130	≤ 30
	4,4-DDT	30-150	≤ 50	40-140	≤ 30
	Aldrin	30-130	≤ 50	40-130	≤ 30
	Dieldrin	30-140	≤ 50	40-130	≤ 30
	Endrin	30-150	≤ 50	40-130	≤ 30
	Heptachlor	30-140	≤ 50	40-130	≤ 30
	Surrogates:				
	Decachlorobiphenyl	30-140	N/A	30-140	N/A
	Tetrachloro-m-xylene	30-140	N/A	30-140	N/A
EPA Method 8082	Aroclor 1016	50-140	≤ 50	50-140	≤ 40
	Aroclor 1260	50-140	≤ 50	50-140	≤ 40
	Surrogate:				
	Decachlorobiphenyl	30-140	N/A	30-140	N/A
	Tetrachloro-m-xylene	30-140	N/A	30-140	N/A
EPA Method 8260B	1,1-Dichloroethene	65-135	≤ 30	75-125	≤ 20
	Benzene	65-135	≤ 30	75-125	≤ 20
	Chlorobenzene	65-135	≤ 30	75-125	≤ 20
	Trichloroethene	65-135	≤ 30	75-125	≤ 20
	Toluene	65-135	≤ 30	75-125	≤ 20
	Surrogates:				
	Toluene-d8	65-135	N/A	75-125	N/A
	4-Bromofluorobenzene	65-135	N/A	75-125	N/A
	1,2-Dichloroethane-d4	65-135	N/A	75-125	N/A
EPA Method 8270C	1,2,4-Trichlorobenzene	34-152	≤ 30	44-142	≤ 30
	1,4-Dichlorobenzene	25-135	≤ 30	30-125	≤ 30
	2,4-Dinitrotoluene	29-149	≤ 30	39-139	≤ 30
	Acenaphthene	39-135	≤ 30	49-125	≤ 30
	2-Chlorophenol	31-135	≤ 30	41-125	≤ 30

TABLE A-1

METHOD PRECISION AND ACCURACY GOALS

Method	Analyte	Accuracy Soil (% R)	Precision Soil (RPD)	Accuracy Water (% R)	Precision Water (RPD)
EPA Method 8270C (continued)	n-Nitrosodi-n-propylamine	27-135	≤ 30	37-125	≤ 30
	4-Chloro-3-methyl phenol	34-135	≤ 30	44-125	≤ 30
	4-Nitrophenol	25-141	≤ 30	25-131	≤ 30
	Pentachlorophenol	38-146	≤ 30	28-136	≤ 30
	Phenol	25-135	≤ 30	25-125	≤ 30
	Pyrene	37-146	≤ 30	47-136	≤ 30
	<i>Surrogates</i>				
	2,4,6-Tribromophenol	25-144	N/A	25-134	N/A
	2-Fluorobiphenyl	34-135	N/A	43-125	N/A
	2-Fluorophenol	25-135	N/A	25-125	N/A
	Nitrobenzene-d5	25-135	N/A	32-125	N/A
	Phenol-d5	25-135	N/A	25-125	N/A
	Terphenyl-d14	32-136	N/A	42-126	N/A

Notes

%R – percent recovery

BHC – benzene hexachloride

DDT – dichlorodiphenyltrichloroethane

EPA – U.S. Environmental Protection Agency

N/A – not applicable

RPD – relative percent difference

ATTACHMENT B

PROJECT-REQUIRED REPORTING LIMITS

TABLE B-1

PROJECT-REQUIRED REPORTING LIMITS

Parameter/ Method	Analyte	Soil/Sediment				
		PRRL	Unit	Action Levels for Soil/Sediment Sampling ^a	Action Levels for Import Material ^b	Action Levels for IDW ^c
Title 22 Metals EPA Method 6010B/7000	Antimony	3	mg/kg	NE	NE	500
	Arsenic	0.25	mg/kg	NE	NE	500
	Barium	0.5	mg/kg	NE	NE	10,000
	Beryllium	0.1	mg/kg	NE	NE	75
	Cadmium	0.25	mg/kg	37/184	37	100
	Chromium	0.5	mg/kg	NE	NE	2,500
	Cobalt	1	mg/kg	NE	NE	8,000
	Copper	0.5	mg/kg	NE	NE	2,500
	Lead	1	mg/kg	150/173	150	1,000
	Mercury	0.1	mg/kg	23/1.52	23	20
	Molybdenum	5	mg/kg	NE	NE	3,500
	Nickel	1	mg/kg	NE	NE	2,000
	Selenium	0.25	mg/kg	390/0.926	390	100
	Silver	0.25	mg/kg	390/13.7	390	500
	Thallium	0.25	mg/kg	NE	NE	700
	Vanadium	0.5	mg/kg	NE	NE	2,400
	Zinc	1	mg/kg	23,000/720	23,000	5,000
PCBs EPA Method 8082	Aroclor 1016	12	µg/kg	NE	NE	50,000 ^d
	Aroclor 1221	24	µg/kg	NE	NE	50,000 ^d
	Aroclor 1232	12	µg/kg	NE	NE	50,000 ^d
	Aroclor 1242	12	µg/kg	NE	NE	50,000 ^d
	Aroclor 1248	12	µg/kg	NE	NE	50,000 ^d
	Aroclor 1254	12	µg/kg	220/350 ^d	220 ^d	50,000 ^d
	Aroclor 1260	12	µg/kg	220/350 ^d	220 ^d	50,000 ^d
Organochlorine Pesticides EPA Method 8081A	alpha-BHC	1.7	µg/kg	NE	NE	NE
	beta-BHC	1.7	µg/kg	NE	NE	NE
	delta-BHC	1.7	µg/kg	NE	NE	NE
	gamma-BHC (Lindane)	1.7	µg/kg	NE	NE	4,000
	Chlordane (Sum of alpha and gamma-chlordane)	30	µg/kg	1.6/931	1,600	2,500
	DDD ^e	3.3	µg/kg	2.4/NE	2,400	1,000 ^f
	DDE ^e	3.3	µg/kg	1.7/NE	1,700	1,000 ^f
	DDT ^e	3.3	µg/kg	1.7/NE	1,700	1,000 ^f
	Aldrin	1.7	µg/kg	NE	NE	1,400
	Dieldrin	3.3	µg/kg	NE	NE	8,000
	Endosulfan I	3.3	µg/kg	NE	NE	NE
	Endosulfan II	3.3	µg/kg	NE	NE	NE
	Endosulfan Sulfate	3.3	µg/kg	NE	NE	NE
	Endrin	3.3	µg/kg	NE	NE	200
	Endrin Aldehyde	3.3	µg/kg	NE	NE	NE
	Endrin Ketone	3.3	µg/kg	NE	NE	NE
	Heptachlor	1.7	µg/kg	NE	NE	4,700
	Heptachlor Epoxide	1.7	µg/kg	NE	NE	4,700
	Methoxychlor	17	µg/kg	NE	NE	100,000
	Toxaphene	60	µg/kg	NE	NE	5,000
	Total DDT ^f	3.3	µg/kg	NE/64.8	1,700	N/A

TABLE B-1

PROJECT-REQUIRED REPORTING LIMITS

Parameter/ Method	Analyte	Soil/Sediment				
		PRRL	Unit	Action Levels for Soil/Sediment Sampling ^a	Action Levels for Import Material ^b	Action Levels for IDW ^c
VOCs EPA Method 5035/8260B	1,1,1-Trichloroethane	5	µg/kg	NE	NE	NE
	1,1,2,2-Tetrachloroethane	5	µg/kg	NE	NE	NE
	1,1,2-Trichloroethane	5	µg/kg	NE	NE	NE
	1,1-Dichloroethane	5	µg/kg	NE	NE	NE
	1,1-Dichloroethene	5	µg/kg	NE	NE	NE
	1,2-Dichloroethane	5	µg/kg	NE	NE	NE
	1,2-Dichloropropane	5	µg/kg	NE	NE	NE
	2-Hexanone	50	µg/kg	NE	NE	NE
	Acetone	50	µg/kg	NE	NE	NE
	Benzene	5	µg/kg	NE	NE	NE
	Bromodichloromethane	5	µg/kg	NE	NE	NE
	Bromoform	5	µg/kg	NE	NE	NE
	Bromomethane	5	µg/kg	NE	NE	NE
	Carbon tetrachloride	5	µg/kg	NE	NE	NE
	Chlorobenzene	5	µg/kg	NE	NE	NE
	Chloroethane	5	µg/kg	NE	NE	NE
	Chloroform	5	µg/kg	NE	NE	NE
	Chloromethane	5	µg/kg	NE	NE	NE
	cis-1,2-Dichloroethene	5	µg/kg	NE	NE	NE
	cis-1,3-Dichloropropene	5	µg/kg	NE	NE	NE
	Dibromochloromethane	5	µg/kg	NE	NE	NE
	Ethylbenzene	5	µg/kg	NE	NE	NE
	Methyl ethyl ketone (MEK) or 2-butanone	50	µg/kg	NE	NE	NE
	Methyl tert-butyl ether (MTBE)	10	µg/kg	NE	NE	NE
	Methylene chloride	5	µg/kg	NE	NE	NE
	Methyl isobutyl ketone (MIBK)	50	µg/kg	NE	NE	NE
	Styrene	5	µg/kg	NE	NE	NE
	Tetrachloroethene	5	µg/kg	NE	NE	NE
	Toluene	5	µg/kg	NE	NE	NE
	trans-1,2-Dichloroethene	5	µg/kg	NE	NE	NE
	trans-1,3-Dichloropropene	5	µg/kg	NE	NE	NE
	Trichloroethene	5	µg/kg	NE	NE	2,040,000
	Vinyl acetate	50	µg/kg	NE	NE	NE
	Vinyl chloride	5	µg/kg	NE	NE	NE
	Xylenes (Total)	15	µg/kg	NE	NE	NE
SVOCs EPA Method 8270C	1,2,4-Trichlorobenzene	330	µg/kg	NE	NE	NE
	1,2-Dichlorobenzene	330	µg/kg	NE	NE	NE
	1,3-Dichlorobenzene	330	µg/kg	NE	NE	NE
	1,4-Dichlorobenzene	330	µg/kg	NE	NE	NE
	2,4,5-Trichlorophenol	1600	µg/kg	NE	NE	NE
	2,4,6-Trichlorophenol	330	µg/kg	NE	NE	NE
	2,4-Dichlorophenol	330	µg/kg	NE	NE	NE
	2,4-Dimethylphenol	330	µg/kg	NE	NE	NE
	2,4-Dinitrophenol	1600	µg/kg	NE	NE	NE
	2,4-Dinitrotoluene	330	µg/kg	NE	NE	NE

TABLE B-1
PROJECT-REQUIRED REPORTING LIMITS

Parameter/ Method	Analyte	Soil/Sediment				
		PRRL	Unit	Action Levels for Soil/Sediment Sampling ^a	Action Levels for Import Material ^b	Action Levels for IDW ^c
	2,6-Dinitrotoluene	330	µg/kg	NE	NE	NE
	2-Chloronaphthalene	330	µg/kg	NE	NE	NE
	2-Chlorophenol	330	µg/kg	NE	NE	NE
	2-Methylphenol	330	µg/kg	NE	NE	NE
	2-Nitroaniline	1600	µg/kg	NE	NE	NE
	2-Nitrophenol	330	µg/kg	NE	NE	NE
	3,3'-Dichlorobenzidine	330	µg/kg	NE	NE	NE
	3-Nitroaniline	1600	µg/kg	NE	NE	NE
	3/4-Methylphenol	330	µg/kg	NE	NE	NE
	4,6-Dinitro-2-methylphenol	1600	µg/kg	NE	NE	NE
	4-Bromophenyl phenyl ether	330	µg/kg	NE	NE	NE
	4-Chloro-3-methylphenol	330	µg/kg	NE	NE	NE
	4-Chloroaniline	330	µg/kg	NE	NE	NE
	4-Chlorophenyl phenyl ether	330	µg/kg	NE	NE	NE
	4-Nitroaniline	1600	µg/kg	NE	NE	NE
	4-Nitrophenol	1600	µg/kg	NE	NE	NE
	bis(2-Chloroethoxy)methane	330	µg/kg	NE	NE	NE
	bis(2-Chloroethyl) ether	30 ^h	µg/kg	NE	NE	NE
	bis(2-Chloroisopropyl)ether	330	µg/kg	NE	NE	NE
	bis(2-Ethylhexyl)phthalate	330	µg/kg	NE	NE	NE
	Butyl benzylphthalate	330	µg/kg	NE	NE	NE
	Di-n-butylphthalate	330	µg/kg	NE	NE	NE
	Di-n-octylphthalate	330	µg/kg	NE	NE	NE
	Dibenzofuran	330	µg/kg	NE	NE	NE
	Diethyl phthalate	330	µg/kg	NE	NE	NE
	Dimethyl phthalate	330	µg/kg	NE	NE	NE
	Hexachlorobenzene	20 ^h	µg/kg	NE	NE	NE
	Hexachlorobutadiene	330	µg/kg	NE	NE	NE
	Hexachlorocyclopentadiene	330	µg/kg	NE	NE	NE
	Hexachloroethane	330	µg/kg	NE	NE	NE
	n-Nitroso-di-n-propylamine	20 ^h	µg/kg	NE	NE	NE
	n-Nitrosodiphenylamine	330	µg/kg	NE	NE	NE
	Nitrobenzene	330	µg/kg	NE	NE	NE
	Pentachlorophenol	330	µg/kg	NE	NE	17,000
	Phenol	330	µg/kg	NE	NE	NE
	Pyridine	330	µg/kg	NE	NE	NE
	Acenaphthene	330	µg/kg	NE	NE	NE
	Acenaphthylene	330	µg/kg	NE	NE	NE
	Anthracene	330	µg/kg	NE	NE	NE
	Benzo[a]anthracene	330	µg/kg	NE	NE	NE
	Benzo[a]pyrene	20 ^h	µg/kg	NE	NE	NE
	Benzo[b]fluoranthene	330	µg/kg	NE	NE	NE
	Benzo[g,h,i]perylene	330	µg/kg	NE	NE	NE
	Benzo[k]fluoranthene	330	µg/kg	NE	NE	NE
	Chrysene	330	µg/kg	NE	NE	NE
	Dibenz[a,h]anthracene	20 ^h	µg/kg	NE	NE	NE
	Fluoranthene	330	µg/kg	NE	NE	NE
	Fluorene	330	µg/kg	NE	NE	NE

TABLE B-1
PROJECT-REQUIRED REPORTING LIMITS

Parameter/ Method	Analyte	Soil/Sediment				
		PRRL	Unit	Action Levels for Soil/Sediment Sampling^a	Action Levels for Import Material^b	Action Levels for IDW^c
	Indeno[1,2,3-cd]pyrene	330	µg/kg	NE	NE	NE
	Naphthalene	330	µg/kg	NE	NE	NE
	Phenanthrene	330	µg/kg	NE	NE	NE
	Pyrene	330	µg/kg	NE	NE	NE
Asbestos CARB Method 435 (for backfill material)	Asbestos	0.25	%	NE	0.25	NE

TABLE B-1

PROJECT-REQUIRED REPORTING LIMITS

Parameter/Method	Analyte	Water ⁱ				
		PRRL	Unit	Discharge Limit ^k	STLC Limit	TCLP Limit
Title 22 Metals EPA Method 6010B/7000	Antimony	60	µg/L	NE	15,000	NE
	Arsenic	5	µg/L	NE	5,000	5,000
	Barium	10	µg/L	NE	100,000	100,000
	Beryllium	2	µg/L	NE	750	NE
	Cadmium	5	µg/L	NE	1,000	1,000
	Chromium	10	µg/L	NE	5,000	5,000
	Cobalt	20	µg/L	NE	80,000	NE
	Copper	20	µg/L	NE	25,000	NE
	Lead	3	µg/L	NE	5,000	5,000
	Mercury	0.2	µg/L	NE	200	200
	Molybdenum	20	µg/L	NE	350,000	NE
	Nickel	20	µg/L	NE	20,000	NE
	Selenium	5	µg/L	NE	1,000	1,000
	Silver	5	µg/L	NE	5,000	5,000
	Thallium	5	µg/L	NE	7,000	NE
	Vanadium	10	µg/L	NE	24,000	NE
	Zinc	20	µg/L	NE	250,000	NE
PCBs EPA Method 8082	Aroclor 1016	0.5	µg/L	NE	5,000 ^d	NE
	Aroclor 1221	1	µg/L	NE	5,000 ^d	NE
	Aroclor 1232	0.5	µg/L	NE	5,000 ^d	NE
	Aroclor 1242	1	µg/L	NE	5,000 ^d	NE
	Aroclor 1248	1	µg/L	NE	5,000 ^d	NE
	Aroclor 1254	1	µg/L	NE	5,000 ^d	NE
	Aroclor 1260	1	µg/L	NE	5,000 ^d	NE
Organochlorine Pesticides EPA Method 8081A	4,4'-DDD	0.1	µg/L	NE	100 ^f	NE
	4,4'-DDE	0.1	µg/L	NE	100 ^f	NE
	4,4'-DDT	0.1	µg/L	NE	100 ^f	NE
	Aldrin	0.05	µg/L	NE	140	NE
	alpha-BHC	0.05	µg/L	NE	NE	NE
	beta-BHC	0.05	µg/L	NE	NE	NE
	Chlordane (technical)	0.1	µg/L	NE	250	30
	delta-BHC	0.1	µg/L	NE	NE	NE
	Dieldrin	0.05	µg/L	NE	800	NE
	Endosulfan I	0.1	µg/L	NE	NE	NE
	Endosulfan II	0.05	µg/L	NE	NE	NE
	Endosulfan sulfate	0.5	µg/L	NE	NE	NE
	Endrin	0.1	µg/L	NE	20	20
	Endrin aldehyde	0.2	µg/L	NE	NE	NE
	gamma-BHC (Lindane)	0.05	µg/L	NE	400	400
	Heptachlor	0.05	µg/L	NE	470	8 ^j
	Heptachlor epoxide	1	µg/L	NE	470	8 ^j
	Methoxychlor	2	µg/L	NE	10,000	10,000
	Toxaphene	2	µg/L	NE	500	500
VOCs EPA Method 8260B	1,1,1-Trichloroethane	5	µg/L	NE	NE	NE
	1,1,2,2-Tetrachloroethane	5	µg/L	NE	NE	NE
	1,1,2-Trichloroethane	5	µg/L	NE	NE	NE
	1,1-Dichloroethane	5	µg/L	NE	NE	NE
	1,1-Dichloroethene	5	µg/L	NE	NE	700

TABLE B-1

PROJECT-REQUIRED REPORTING LIMITS

Parameter/Method	Analyte	Water ⁱ				
		PRRL	Unit	Discharge Limit ^k	STLC Limit	TCLP Limit
	1,2-Dichloroethane	5	µg/L	NE	NE	500
	1,2-Dichloropropane	5	µg/L	NE	NE	NE
	2-Hexanone	50	µg/L	NE	NE	NE
	Acetone	50	µg/L	NE	NE	NE
	Benzene	0.5	µg/L	NE	NE	500
	Bromodichloromethane	5	µg/L	NE	NE	NE
	Bromoform	5	µg/L	NE	NE	NE
	Bromomethane	5	µg/L	NE	NE	NE
	Carbon tetrachloride	5	µg/L	NE	NE	500
	Chlorobenzene	5	µg/L	NE	NE	100,000
	Chloroethane	5	µg/L	NE	NE	NE
	Chloroform	5	µg/L	NE	NE	6,000
	Chloromethane	5	µg/L	NE	NE	NE
	cis-1,2-Dichloroethene	5	µg/L	NE	NE	NE
	cis-1,3-Dichloropropene	5	µg/L	NE	NE	NE
	Dibromochloromethane	5	µg/L	NE	NE	NE
	Ethylbenzene	0.5	µg/L	NE	NE	NE
	Methyl ethyl ketone (MEK)	50	µg/L	NE	NE	200,000
	Methyl tert-butyl ether (MTBE)	1	µg/L	NE	NE	NE
	Methylene chloride	5	µg/L	NE	NE	NE
	Methyl isobutyl ketone (MIBK)	50	µg/L	NE	NE	NE
	Styrene	5	µg/L	NE	NE	NE
	Tetrachloroethene	5	µg/L	NE	NE	700
	Toluene	0.5	µg/L	NE	NE	NE
	trans-1,2-Dichloroethene	5	µg/L	NE	NE	NE
	trans-1,3-Dichloropropene	5	µg/L	NE	NE	NE
	Trichloroethene	5	µg/L	NE	204,000	500
	Vinyl acetate	50	µg/L	NE	NE	NE
	Vinyl chloride	5	µg/L	NE	NE	200
	Xylenes (Total)	1.5	µg/L	NE	NE	NE
SVOCs EPA Method 8270C	1,2,4-Trichlorobenzene	10	µg/L	NE	NE	NE
	1,2-Dichlorobenzene	10	µg/L	NE	NE	NE
	1,3-Dichlorobenzene	10	µg/L	NE	NE	NE
	1,4-Dichlorobenzene	10	µg/L	NE	NE	7,500
	2,4,5-Trichlorophenol	10	µg/L	NE	NE	400,000
	2,4,6-Trichlorophenol	10	µg/L	NE	NE	2,000
	2,4-Dichlorophenol	10	µg/L	NE	NE	NE
	2,4-Dimethylphenol	10	µg/L	NE	NE	NE
	2,4-Dinitrophenol	50	µg/L	NE	NE	NE
	2,4-Dinitrotoluene	10	µg/L	NE	NE	130
	2,6-Dinitrotoluene	10	µg/L	NE	NE	NE
	2-Chloronaphthalene	10	µg/L	NE	NE	NE
	2-Chlorophenol	10	µg/L	NE	NE	NE
	2-Methylphenol	10	µg/L	NE	NE	200,000
	2-Nitroaniline	50	µg/L	NE	NE	NE
	2-Nitrophenol	10	µg/L	NE	NE	NE
	3,3'-Dichlorobenzidine	20	µg/L	NE	NE	NE
	3-Nitroaniline	50	µg/L	NE	NE	NE

TABLE B-1

PROJECT-REQUIRED REPORTING LIMITS

Parameter/Method	Analyte	Water ⁱ				
		PRRL	Unit	Discharge Limit ^k	STLC Limit	TCLP Limit
	3/4-Methylphenol	10	µg/L	NE	NE	200,000
	4,6-Dinitro-2-methylphenol	50	µg/L	NE	NE	NE
	4-Bromophenyl phenyl ether	10	µg/L	NE	NE	NE
	4-Chloro-3-methylphenol	20	µg/L	NE	NE	NE
	4-Chloroaniline	20	µg/L	NE	NE	NE
	4-Chlorophenyl phenyl ether	10	µg/L	NE	NE	NE
	4-Nitroaniline	50	µg/L	NE	NE	NE
	4-Nitrophenol	50	µg/L	NE	NE	NE
	bis(2-Chloroethoxy)methane	10	µg/L	NE	NE	NE
	bis(2-Chloroethyl) ether	10	µg/L	NE	NE	NE
	bis(2-Chloroisopropyl)ether	10	µg/L	NE	NE	NE
	bis(2-Ethylhexyl)phthalate	20	µg/L	NE	NE	NE
	Butyl benzylphthalate	10	µg/L	NE	NE	NE
	Di-n-butylphthalate	10	µg/L	NE	NE	NE
	Di-n-octylphthalate	10	µg/L	NE	NE	NE
	Dibenzofuran	10	µg/L	NE	NE	NE
	Diethyl phthalate	10	µg/L	NE	NE	NE
	Dimethyl phthalate	10	µg/L	NE	NE	NE
	Hexachlorobenzene	10	µg/L	NE	NE	130
	Hexachlorobutadiene	10	µg/L	NE	NE	500
	Hexachlorocyclopentadiene	10	µg/L	NE	NE	NE
	Hexachloroethane	10	µg/L	NE	NE	3,000
	n-Nitroso-di-n-propylamine	10	µg/L	NE	NE	NE
	n-Nitrosodiphenylamine	10	µg/L	NE	NE	NE
	Nitrobenzene	10	µg/L	NE	NE	2,000
	Pentachlorophenol	50	µg/L	NE	1,700	100,000
	Phenol	10	µg/L	NE	NE	NE
	Pyridine	10	µg/L	NE	NE	5,000
	Acenaphthene	10	µg/L	NE	NE	NE
	Acenaphthylene	10	µg/L	NE	NE	NE
	Anthracene	10	µg/L	NE	NE	NE
	Benzo[a]anthracene	10	µg/L	NE	NE	NE
	Benzo[a]pyrene	10	µg/L	NE	NE	NE
	Benzo[b]fluoranthene	10	µg/L	NE	NE	NE
	Benzo[g,h,i]perylene	10	µg/L	NE	NE	NE
	Benzo[k]fluoranthene	10	µg/L	NE	NE	NE
	Chrysene	10	µg/L	NE	NE	NE
	Dibenz[a,h]anthracene	10	µg/L	NE	NE	NE
	Fluoranthene	10	µg/L	NE	NE	NE
	Fluorene	10	µg/L	NE	NE	NE
	Indeno[1,2,3-cd]pyrene	10	µg/L	NE	NE	NE
	Naphthalene	10	µg/L	NE	NE	NE
	Phenanthrene	10	µg/L	NE	NE	NE
	Pyrene	10	µg/L	NE	NE	NE
Turbidity	Turbidity	NE	NTU	NE	NE	NE

TABLE B-1

PROJECT-REQUIRED REPORTING LIMITS

Notes

- a Action levels listed are for soil and sediment samples for Remedial Action Objectives (RAOs) (Cleanup Goals) established for Site 27 for the chemicals of potential ecological concern (COPECs). RAOs for soil are based on the EPA Region 9 PRGs established for residential soils (EPA, 2004a). RAOs for sediments were identified in the Records of Decision (ROD). RAOs are listed as follows in the table: RAO for soil / RAO for sediments.
- b Action levels for import materials are based on EPA Region 9 PRGs established for residential soils (EPA, 2004a). The action levels are established for Site 27 for the COPECs only. For analytes with California modified PRGs, these values will be used instead of EPA Region 9 PRGs.
- c Action levels for IDW are based on the California Title 22 TTLC values. Additional analyses such as STLC and TCLP may be required for the soil/sediment samples based on 10 times the STLC or 20 times the TCLP limits listed under the water section of this table.
- d Action level listed is for total PCBs (the sum of Aroclor-1254 and Aroclor-1260).
- e DDD is the sum of 2,4-DDD and 4,4-DDD. DDE is the sum of 2,4-DDE and 4,4-DDE. DDT is the sum of 2,4-DDT and 4,4-DDT.
- f Action level listed is for the sum of 4,4-DDD, 4,4- DDE, and 4,4-DDT.
- g The PRG listed is for total 1,3-dichloropropene; however, laboratories report individual isomers: cis- and trans-1,3-dichloropropene.
- h EPA Method 8270C by Selective Ion Monitoring will be performed for these analytes to achieve lower reporting limits to meet action level listed for import fill samples only. Otherwise, the standard EPA Method 8270C will be performed.
- i Water samples include equipment rinsate samples (as applicable) and wastewater samples collected for waste profiling. STLC and TCLP limits will be used for wastewater characterization for disposal only. Discharge water will be compared against baseline sample results. Baseline sample will be collected prior to start of excavation.
- j Action level listed is for the sum of heptachlor and heptachlor epoxide.
- k The basic discharge requirement from the Water Board for turbidity are listed in Section 2.1.5. The discharge requirement for total DDT and total PCBs will be based on the baseline sample results collected prior to start of excavation. The baseline sample results will be the monitoring guide for discharging back into the Northern Channel.

µg/kg – micrograms per kilogram

µg/L – micrograms per liter

BHC – benzene hexachloride

CARB – California Air Resources Board

DDD – 4,4'-dichlorodiphenyldichloroethane

DDE – 4,4'-dichlorodiphenyldichloroethene

DDT – 4,4'-dichlorodiphenyltrichloroethane

EPA – U.S. Environmental Protection Agency

IDW – investigation-derived waste

mg/kg – milligrams per kilogram

N/A – not applicable

NE – none established

PCB – polychlorinated biphenyl

POTW – publicly owned treatment works

PRG – Preliminary Remediation Goal

PRRL – project-required reporting limit

STLC – Soluble Threshold Limit Concentration

SVOC – semivolatile organic compound

TCLP – Toxicity Characteristic Leaching Procedure

TTLC – Total Threshold Limit Concentration

VOC – volatile organic compound

APPENDIX D

DATA MANAGEMENT PLAN

APPENDIX D
DRAFT FINAL
DATA MANAGEMENT PLAN

FOR

SITE 27
FORMER NAVAL AIR STATION MOFFETT FIELD,
SANTA CLARA COUNTY, CALIFORNIA

ENVIRONMENTAL MULTIPLE AWARD CONTRACT
Contract Number N68711-04-D-1105
Contract Task Order 0002

January 13, 2006

Prepared for



Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Prepared by



317 East Main Street
Ventura, California 93001



TETRA TECH EC, INC.

1940 East Deere Avenue, Suite 200
Santa Ana, California 92705

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ABBREVIATIONS AND ACRONYMS

EWI	Environmental Work Instruction
NAD	North American Datum
NAVFAC SW	Naval Facilities Engineering Command, Southwest
NEDD	Naval Electronic Data Deliverable
QC	quality control
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan

1.0 INTRODUCTION

This Data Management Plan was prepared for the Navy and the Base Realignment and Closure Program Management Office West by the TN & Associates, Inc./Tetra Tech EC, Inc. team on behalf of the Naval Facilities Engineering Command, Southwest Environmental Multiple Action Contract No. N68711-04-D-1105. The purpose of this plan is to provide guidance on managing field and laboratory data during the implementation of remedial activities at Site 27 located at the former Naval Air Station Moffett Field.

This plan will be implemented by a contractor selected to construct the remedial design. Therefore, specific data handling equipment (computer hardware/software) and detailed processes are not described in this plan. This plan addresses types of data to be collected, guidance on verification of data, quality assurance/quality control evaluation of data, and submittal of Naval Electronic Data Deliverables to the Navy in accordance with the *Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards* (Southwest Division, Naval Facilities Engineering Command, 2005).

2.0 PROJECT DESCRIPTION

Information on project site location, background, and site physical setting is presented in the Sampling and Analysis Plan.

During the implementation of remedial activities at Site 27, the following types of samples will be collected for chemical analysis:

- In situ sediment for waste characterization
- In situ soil for waste characterization
- Debris sample for waste characterization
- Water samples from runoff from the sediment drying pad for waste characterization
- Confirmation soil samples
- Soil, crushed aggregate base or clay of imported materials

In addition to the chemical data, geotechnical data from imported material testing and location data from the land survey of confirmation sample locations and excavation boundary will be analyzed.

Data are generated in the field by subcontractor laboratories (both chemical and geotechnical), by subcontract validator for analytical data, and by subcontract land surveyor. The contractor will manage data for decision-making, report preparation, and submittal to the Navy.

3.0 DATA MANAGEMENT

Data collected are critical to the implementation of the remedial action. Therefore, an information management system is necessary to ensure efficient access so that decisions based on the data can be made in a timely manner. Information managed in the contractor database should be compatible with requirements in the Naval Electronic Data Deliverable (NEDD) Standard Operating Procedure 1.0 (Navy, 2004).

Chemical and geotechnical samples will be collected in the field, and samplers will record the information on the chain-of-custody records. The samplers will follow the sample collection and field documentation procedures described in the Sampling and Analysis Plan (SAP).

Chemical and geotechnical results will be reported by subcontract laboratories in hard-copy and electronic formats. Electronic data from the laboratories must be compatible with the NEDD format. The required format for electronic deliverables is presented in [Section 1.6.4](#) of the SAP. Requirements of the hard-copy data, described in the [Section 1.6.2](#) and [1.6.3](#) of the SAP, are consistent with information needed to perform independent third-party data validation.

The survey will be done by a civil survey subcontractor. Horizontal control information will be collected in State Plane Coordinate System North American Datum (NAD) 1983 for NEDD-Naval Installation Restoration Information Solution and latitude and longitude (measured as decimal degrees to seven decimal places XXXX.XXXXXXX) for Geo Tracker (if required) deliverables. Vertical control information will be collected in NAD 1988 for both deliverables.

The results will be presented as maps or drawings accurately associated with permanent benchmarks. These maps will be available to project staff in both hard-copy and electronic format.

Field data will be manually entered after being reviewed for completeness and accuracy. These data include sampling dates and locations, field screening and analysis measurements, and information recorded on the contractor field forms.

Data received from laboratories in electronic format will be reviewed for completeness, accuracy, and format, and then loaded into the database. Validation reports will be reviewed by the Project Chemist for accuracy, and the database will be updated with validation data qualifiers, if required.

Validated data in electronic format will be delivered to the Navy in accordance with the *Environmental Work Instruction (EWI) EVR.6, Environmental Data Management and Required Electronic Delivery Standards* (Southwest Division, Naval Facilities Engineering Command, 2005).

As-built drawings will be submitted in the final deliverable. If electronic format of drawings are required by the Remedial Project Manager, they will be in ESRI formats, or a computer-assisted draft format that is easily imported into an ESRI format.

4.0 DATA REVIEW

The on-site Project Quality Control Manager will conduct three phases of inspection (preparatory, initial and follow-up) of field activities, including sampling procedure, field documentation and chain-of-custody, sampling handling and packaging, and collection of field quality control (QC) samples. Samples and chain-of-custody records received by a subcontracted laboratory are inspected prior to being logged into the laboratory system. If any discrepancies are discovered, the Project Chemist is contacted and information is noted in the sample-receiving document to be documented later in a case narrative.

All data reported by the laboratory must be reviewed by the analyst, independent peer analyst (peer review), and responsible supervisor (technical review). One hundred percent of all data must receive management approval prior to release. Annually, at least 10 percent of data reports generated using each analytical method must be reviewed by a member of the quality assurance staff. The detailed review process required by the laboratory is described in the Sampling and Analysis Plan (SAP). It is the responsibility of the laboratory to verify that the Naval Electronic Data Deliverable and the hard-copy reports are identical.

Data packages are reviewed by the Project Chemist for completeness and accuracy, and sent to a subcontract data validator. Following third-party validation, data will be further evaluated by the Project Chemist. The evaluation of data will be based on method requirements and the results of the QC samples, the level of contamination of samples indicated by the method blanks analysis, and the overall indication of interference due to contamination. Data qualifying will be used to alert end users to uncertainties associated with the data.

Field and laboratory data will be verified by the responsible individual, as described in the [Section 4.1](#) of the SAP prior to being loaded into the database. Electronic data, including geotechnical and survey data, will be loaded into the contractor database. The Project Chemist will verify the accuracy of the data in the database, including manually entered field data.

5.0 SECURITY

5.1 BACKUP AND RECOVERY

System failure and other disasters create the potential for accidental data corruption. Procedures for the backup and recovery program will be in place to prevent this possibility. Backup copies of data files and data tables will be archived regularly and stored both locally and in an area outside the computer facility.

6.0 DATA TRANSFER TO THE NAVY

Electronic data will be transferred to the Navy at a frequency determined by the Remedial Project Manager (RPM) in Naval Electronic Data Deliverable (NEDD) format. At a minimum, the following NEDD will be populated and transferred to the Navy:

- CONTRACTOR
- POINT OF CONTACT
- LABORATORY
- ENVIRONMENTAL_PROJECT
- PROGRAM CONTACT
- LOCATION
- ENVIRONMENTAL_SITE
- LOCATION_SITE_XREF
- SAMPLE
- SAMPLE_TRACKING
- SAMPLE_SITE_ZONE_XREF
- ANALYTICAL_RESULT
- QC-RESULTS
- DATA_VALIDATION

The table “EXCAVATION” may be populated if required by the RPM. After the NEDD tables are prepared, the NEDD files will be evaluated using the Data Checker tool. Once the NEDD submittal passes each verification stage of the Data Checker, the submittal will be transferred. The contractor will receive a confirmatory e-mail indicating that a NEDD deliverable was submitted. The e-mail will contain a tracking number, a unique identifier for each submittal assigned to the deliverable. The contractor shall retain the tracking number in the project file. The contractor may be contacted by the Navy Data Manager if a data load error occurred when loading to the Naval Installation Restoration Information Solution.

7.0 REFERENCES

Department of the Navy. 2004. Naval Electronic Data Deliverable Standard Operating Procedure 1. Available at www.NIRIS-NEDD.org.

Southwest Division, Naval Facilities Engineering Command. 2005. *Environmental Work Instruction (EWI) EVR. 6, Environmental Data Management and Required Electronic Delivery Standards*. April.

APPENDIX E

SURVEY DATA

APPENDIX F

GEOTECHNICAL DATA

Ms. Anna Espinoza
TN & Associates, Inc.
317 East Main Street
Ventura, California 93001-2624

Subject: **Results of Geotechnical Testing**
Moffett Air Field Project
Mountain View, California

Dear Ms. Espinoza:

Twining Laboratories of Southern California, Inc. (Twining Laboratories) is pleased to present this report that summarizes the results of geotechnical testing for the Moffett Air Field project in Mountain View, California. This report is provided in accordance with TN & Associates' Subcontract Number SC2005026-3770 and Modification No. 1 of the same subcontract.

PROJECT DESCRIPTION AND SCOPE OF SERVICES

Our understanding of the project is based upon the Request for Proposal (RFP) prepared by TN & Associates (TN&A) dated April 13, 2005, and upon discussions with Mr. Abram Eloskof and Mr. Faouzi Ahtchi-ali of Tetra Tech Environmental Consultants, Inc. Five Shelby tube samples containing soil collected from borings were delivered to Twining Laboratories on May 14, 2005. The chain-of-custody form for transmittal of the samples is attached as Attachment 1. TN&A requested geotechnical testing on the Shelby tube samples.

We understand that the results of the geotechnical testing on the Shelby tube samples will be used in slope stability and other geotechnical analyses. Geotechnical testing on the Shelby tube samples consisted of the following:

- In-place moisture content and density testing in general accordance with ASTM D 2216 and ASTM D 2937;
- Direct shear testing in general accordance with ASTM D 3080;
- Atterberg limits testing in general accordance with ASTM D 4318; and
- Sieve analyses in general accordance with ASTM D 422 (without hydrometer).

Finally, our scope of services includes the preparation of this report summarizing the results of the geotechnical testing.

GEOTECHNICAL TESTING – SHELBY TUBES

Geotechnical testing was performed on four of the five Shelby tube samples delivered to Twining Laboratories in accordance with direction from Mr. Faouzi Atchi of Tetra Tech Environmental Consultants, Inc. In-place moisture/density, sieve analysis, Atterberg limits, and direct shear testing were performed on three of the Shelby tubes (Sample ID's 02-BS-07, 02-BS-09, and 02-BS-10) and in-place moisture density and direct shear testing were performed on Sample ID 02-BS-08. The results of the in-place moisture density tests, sieve analyses, and Atterberg limits are presented on Table 1 – Summary of Classification Testing. The results of the sieve analyses and Atterberg limits are presented on Figures 1 and 2, respectively.

TABLE 1 – SUMMARY OF CLASSIFICATION TESTING

Sample ID	Soil Type	In-place Moisture Content (%)	In-place Dry Density (%)	Percent Passing No. 200 Sieve (%)	Atterberg Limits (LL/PI) ¹
02-BS-07	Sandy organic lean CLAY (OL)	29.2	98.2	54.8	41/25
02-BS-08	Sandy organic lean CLAY (OL)	27.4	97.4	--	--
02-BS-09	Sandy organic fat CLAY (OH)	26.6	95.1	69.4	54/16
02-BS-10	Organic CLAY with sand (OH)	30.6	92.5	80.1	50/18

¹ LL = Liquid Limit, PI = Plasticity Index

Direct shear testing was performed in general accordance with ASTM D 3080. The samples were saturated for approximately 24 hours and then were allowed to consolidate under the normal load at which each sample was sheared. Three of the samples (Sample ID's 02-BS-07, 02-BS-09, and 02-BS-10) were sheared at a rate of approximately 0.005 inches per minute to represent drained conditions during shearing. Sample ID 02-BS-08 was sheared at a rate of 0.02 inches per minute to represent undrained conditions during shearing. The results of the direct shear tests are summarized on Table 2 – Summary of Direct Shear Testing, and plots of the direct shear tests performed are presented as Figures 3 through 6.

TABLE 2 – SUMMARY OF DIRECT SHEAR TESTING

Sample ID	Test Condition ¹	Friction Angle (degree)		Cohesion (psf)	
		Peak	Residual ²	Peak	Residual ²
02-BS-07	Drained	20	20	420	300
02-BS-08	Undrained	20	20	456	450
02-BS-09	Drained	21	21	432	300
02-BS-10	Drained	22	22	384	200

¹ Test was run at a rate of 0.005 in/min for drained conditions and 0.02 in/min for undrained conditions

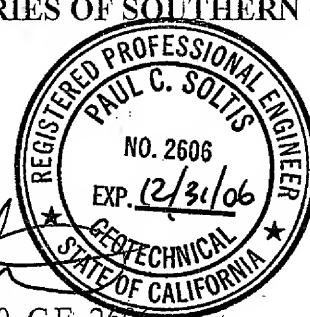

² Residual parameters developed based upon shear stress measured at 0.25 inch displacement

CLOSURE

Twining Laboratories appreciates the opportunity testing services for this important project. Please contact Paul Soltis at (562) 426-3355 with questions regarding this report.

Respectfully submitted,

TWINING LABORATORIES OF SOUTHERN CALIFORNIA, INC.



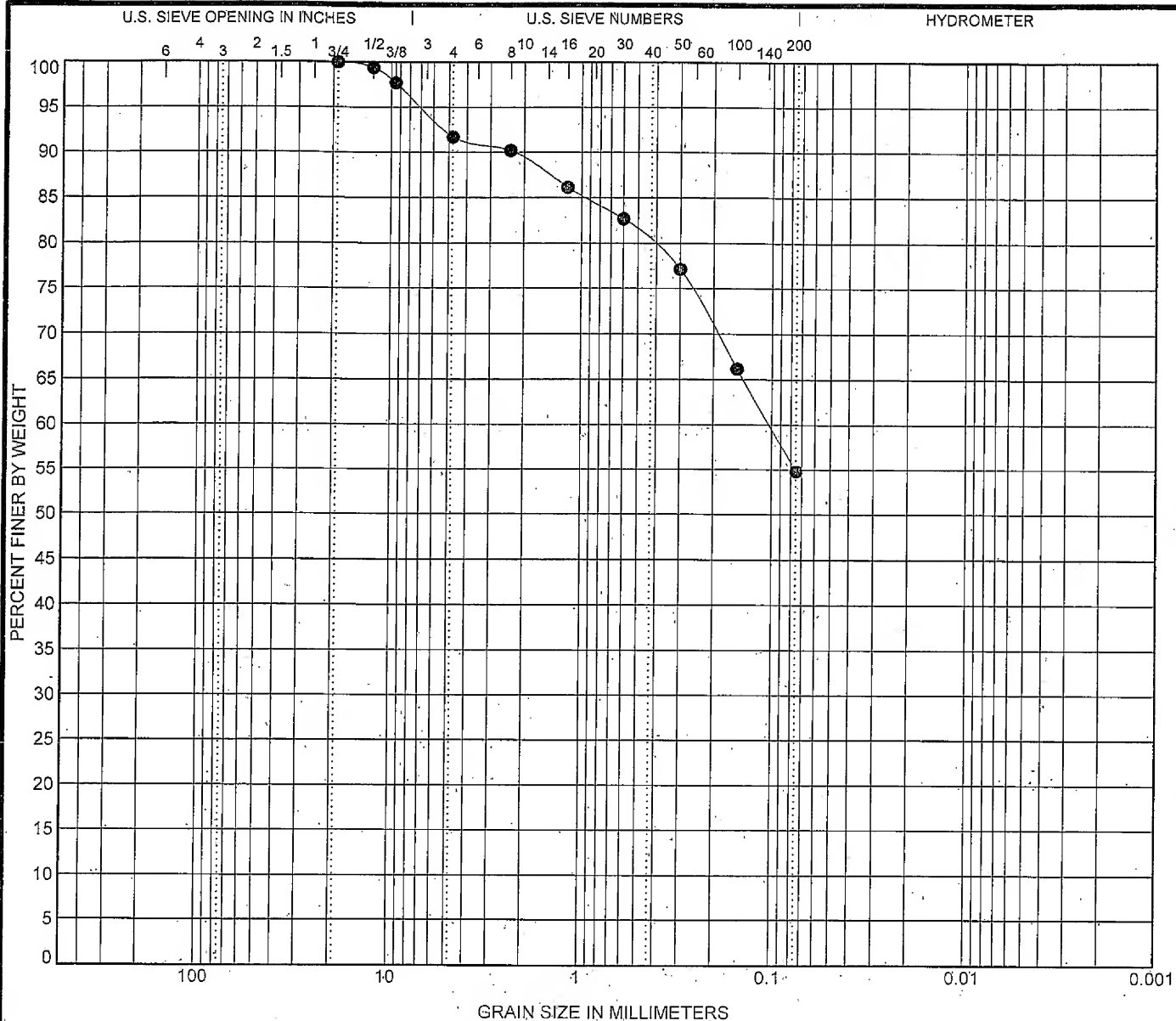
Paul C. Soltis, R.C.E. 56140, G.E. 2606
Senior Engineer



Patrick Sliwinski
Geotechnical Laboratory Manager

PS/BK/EH

Distribution: (3) Addressee
(2) Mr. Abram Eloskof, Tetra Tech Environmental Consultants, Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		U.S.C.S. Classification						Cc	Cu
●	02 -BS - 07	SANDY ORGANIC CLAY(OL)							
D ₁₀₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	%Gravel	%Sand	%Silt	%Clay	
19	0.103				8.3	36.9	54.8		

TWINING
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OF SOUTHERN CALIFORNIA

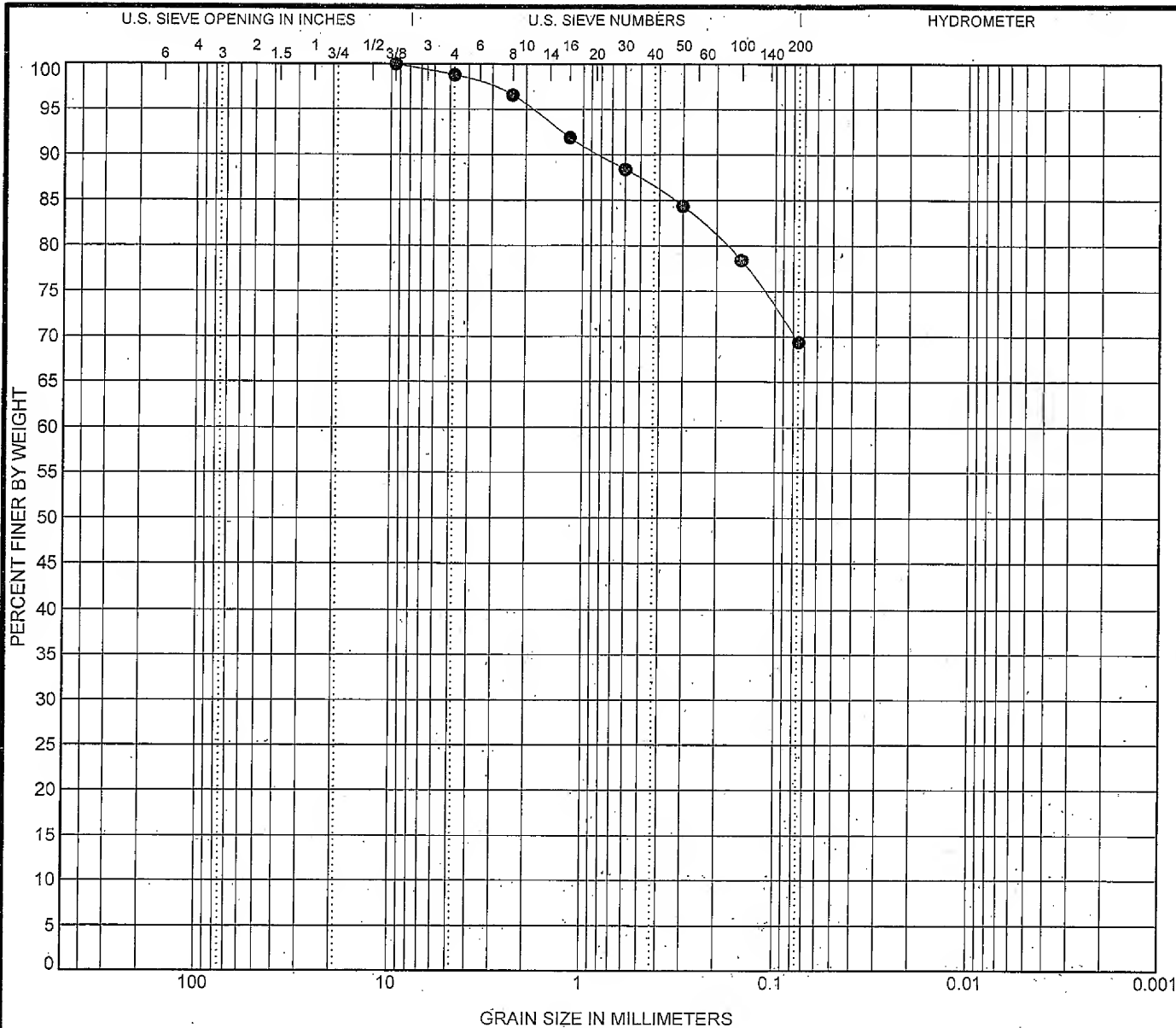
GRAIN SIZE DISTRIBUTION

Moffett Air Field
California

PROJECT NO.
050409

REPORT DATE
June 2005

FIGURE 1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample ID		U.S.C.S. Classification						Cc	Cu
●	02 - BS - 09	SANDY ORGANIC CLAY(OH)							
D ₁₀₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	%Gravel	%Sand	%Silt	%Clay	
9.5					1.2	29.4	69.4		

TWINING
LABORATORIES
OF SOUTHERN CALIFORNIA

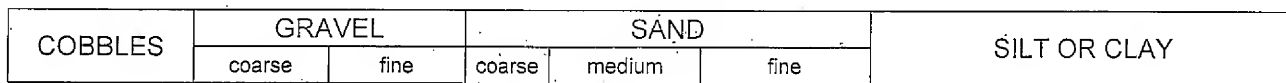
GRAIN SIZE DISTRIBUTION

Moffett Air Field
California

PROJECT NO.
050409

REPORT DATE
June 2005

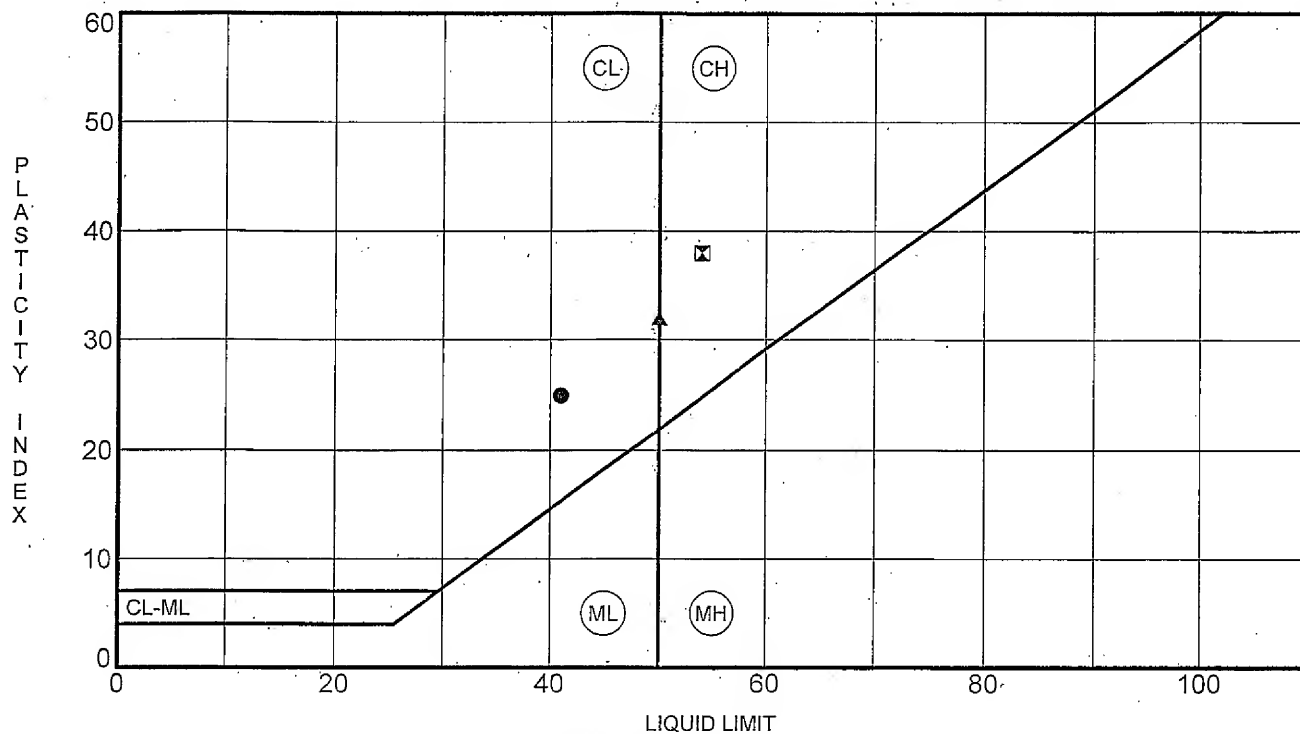
FIGURE 2

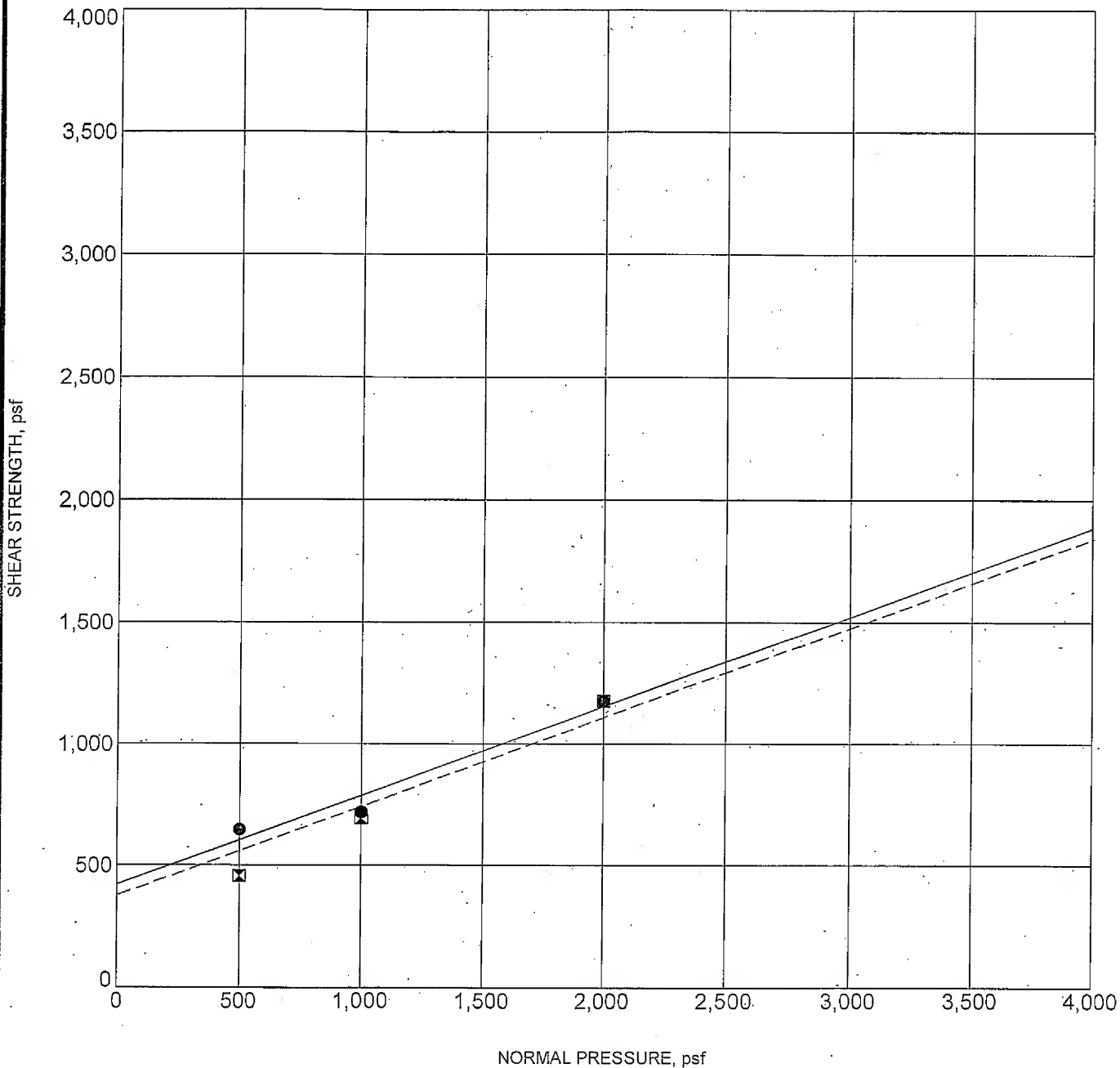


TWINING
LABORATORIES
OF SOUTHERN CALIFORNIA

Moffett Air Field
California

FIGURE 3

[illegible]



Sample ID: 02 - BS - 07
 Sample Depth (ft): -----
 Sample Description: SANDY ORGANIC LEAN CLAY
 Strain Rate (in./min): 0.005
 Dry Density (pcf): 98.2

Shear Strength Parameters
 Peak —●— Residual —■—
 Cohesion, C (psf): 420 216
 Friction Angle, ϕ (deg): 20 26
 Initial Moisture (%): 29.2
 Final Moisture (%): 27.3

TWINING
 LABORATORIES
 OF SOUTHERN CALIFORNIA

DIRECT SHEAR TEST

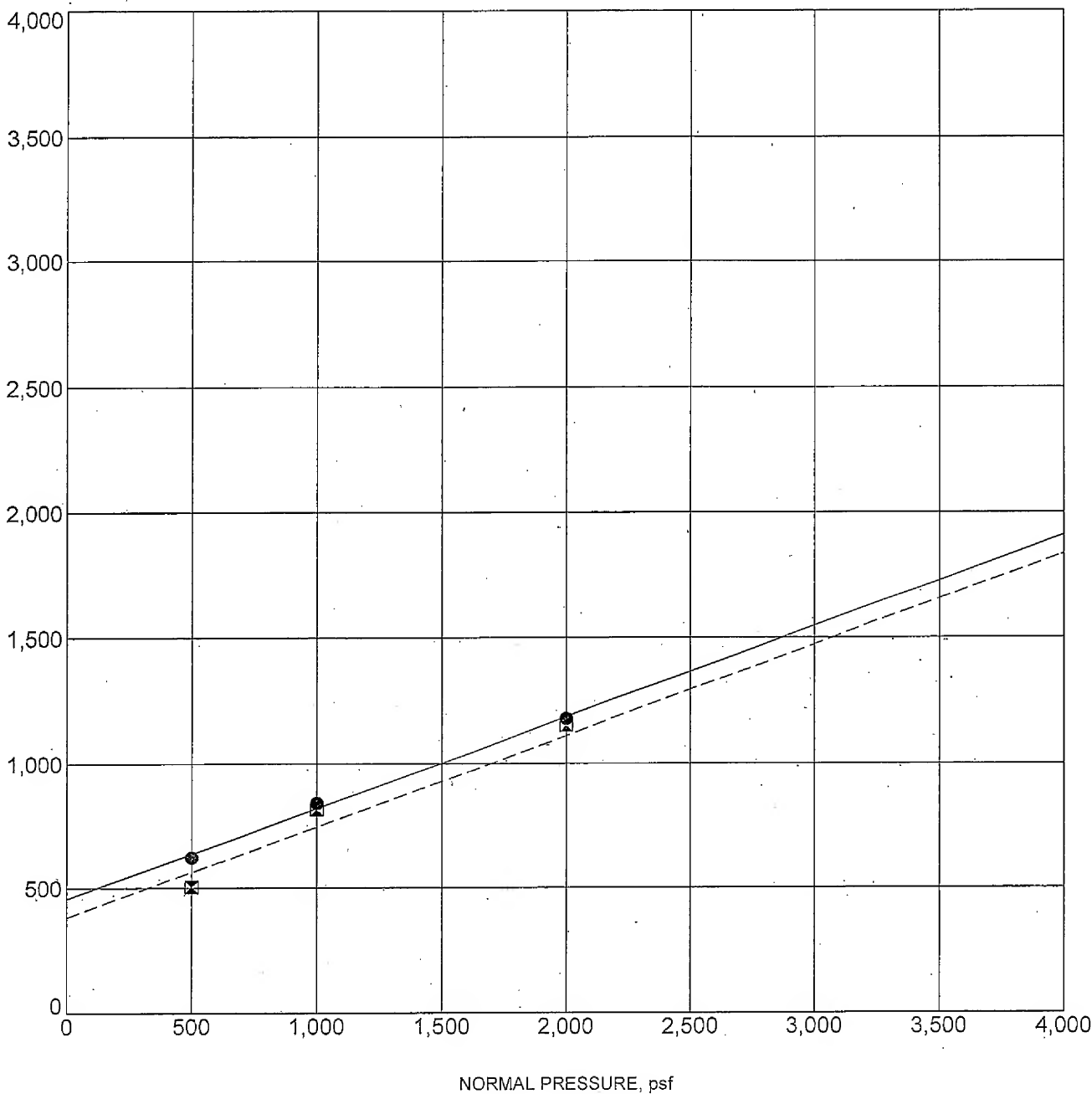
Moffett Air Field
 California

PROJECT NO.
 050409

REPORT DATE
 June 2005

FIGURE 5

SHEAR STRENGTH, psf



Shear Strength Parameters

Peak —●— Residual —■—

Sample ID: 02 - BS -08
 Sample Depth (ft): -----
 Sample Description: ORGANIC LEAN
 CLAY w/ SAND
 Strain Rate (in./min): 0.02
 Dry Density (pcf): 97.4

Cohesion, C (psf): 456 450
 Friction Angle, ϕ (deg): 20 20
 Initial Moisture (%): 27.4
 Final Moisture (%): 28.2

TWINING
 LABORATORIES
 OF SOUTHERN CALIFORNIA

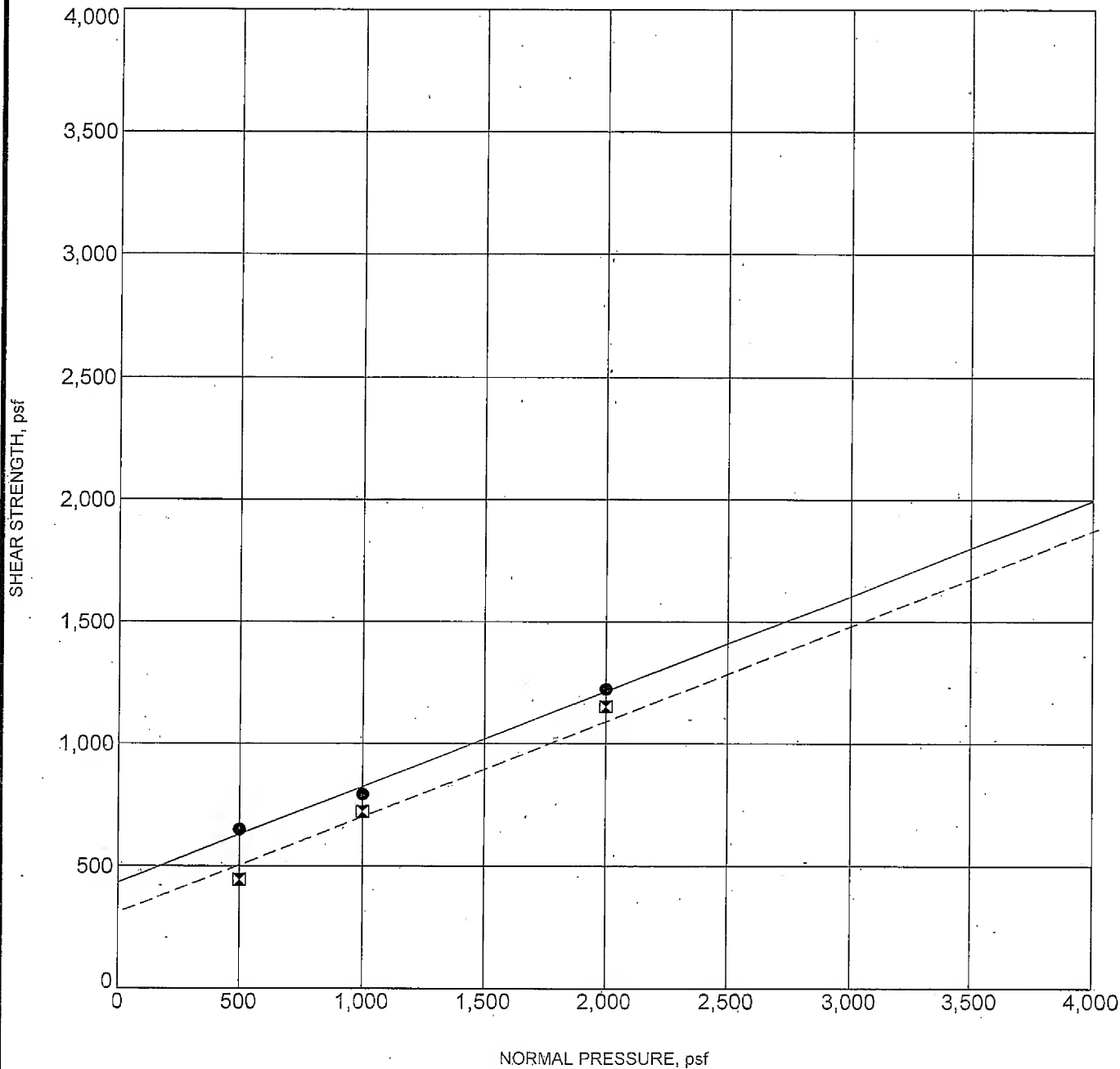
DIRECT SHEAR TEST

Moffett Air Field
 California

PROJECT NO.
 050409

REPORT DATE
 June 2005

FIGURE 6



Sample ID: 02-BS-09
 Sample Depth (ft): -----
 Sample Description: SANDY ORGANIC CLAY(OH)
 Strain Rate (in./min): 0.005
 Dry Density (pcf): 95.1

Shear Strength Parameters
 Peak —●— Residual —×—
 Cohesion, C (psf): 432 300
 Friction Angle, ϕ (deg): 21 21
 Initial Moisture (%): 26.6
 Final Moisture (%): 31.2

TWINING
LABORATORIES
 OF SOUTHERN CALIFORNIA

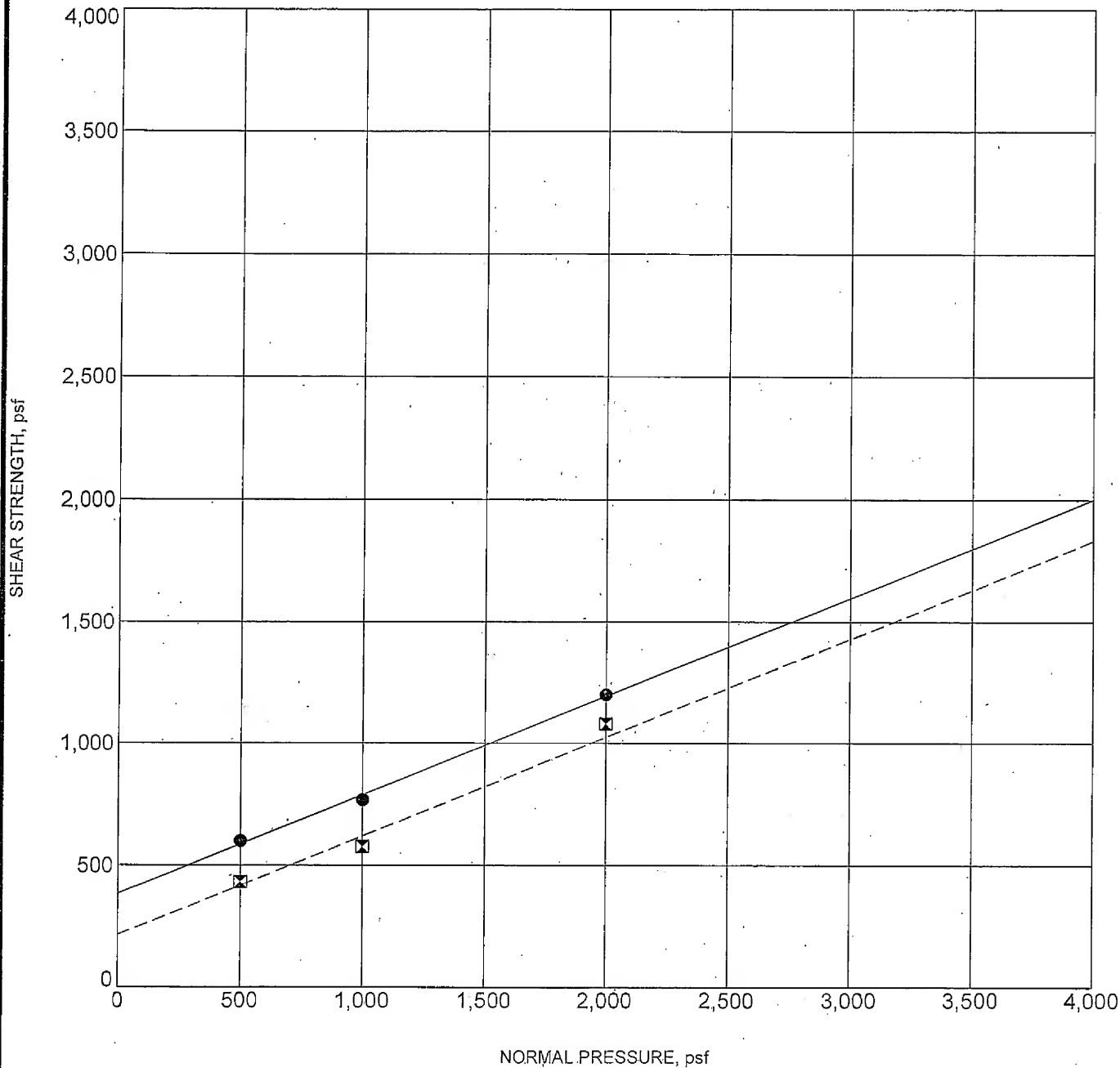
DIRECT SHEAR TEST

Moffett Air Field
 California

PROJECT NO.
 050409

REPORT DATE
 June 2005

FIGURE 7



Sample ID: 02 - BS - 10
Sample Depth (ft): ----
Sample Description: ORGANIC CLAY w/ SAND(OH)
Strain Rate (in./min): 0.005
Dry Density (pcf): 92.5

Shear Strength Parameters
 Peak —●— Residual —■—
Cohesion, C (psf): 384 200
Friction Angle, Ø (deg): 22 22
Initial Moisture (%): 30.6
Final Moisture (%): 34.0



DIRECT SHEAR TEST

Moffett Air Field
California

PROJECT NO.
050409

REPORT DATE
June 2005

FIGURE 8

NUMBER 06032

CHAIN-OF-CUSTODY RECORD

[illegible]

White - Laboratory; Pink - Laboratory; Canary - Project File; Manila - Data Management

RESULTS OF UNCONFINED COMPRESSION TESTING

Project No.: 050409
July 14, 2005

Ms. Anna Espinoza
TN & Associates, Inc.
317 East Main Street
Ventura, California 93001-2624

Subject: **Results of Unconfined Compression Testing**
Moffett Air Field Project
Mountain View, California

Dear Ms. Espinoza:

Twining Laboratories of Southern California, Inc. (Twining Laboratories) is pleased to present this report that summarizes the results of unconfined compression testing performed for the Moffett Air Field project in Mountain View, California. This report is provided in accordance with TN & Associates' Subcontract Number SC2005026-3770 and Modification No. 2 of the same subcontract.

One unconfined compression test was performed on Sample ID 02-BS-08. The results of the test are attached as Figure 1. The results indicate an unconfined compressive strength of 2220 pounds per square foot. The moisture content and dry density of the sample tested were found to be approximately 22.4 percent and 113.2 pounds per cubic foot.

Twining Laboratories appreciates the opportunity testing services for this important project. Please contact Paul Soltis at (562) 426-3355 with questions regarding this report.

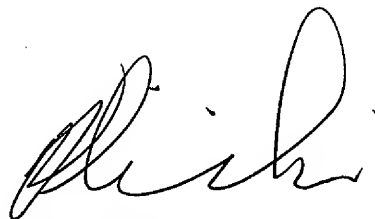
Respectfully submitted,

TWINING LABORATORIES OF SOUTHERN CALIFORNIA, INC.



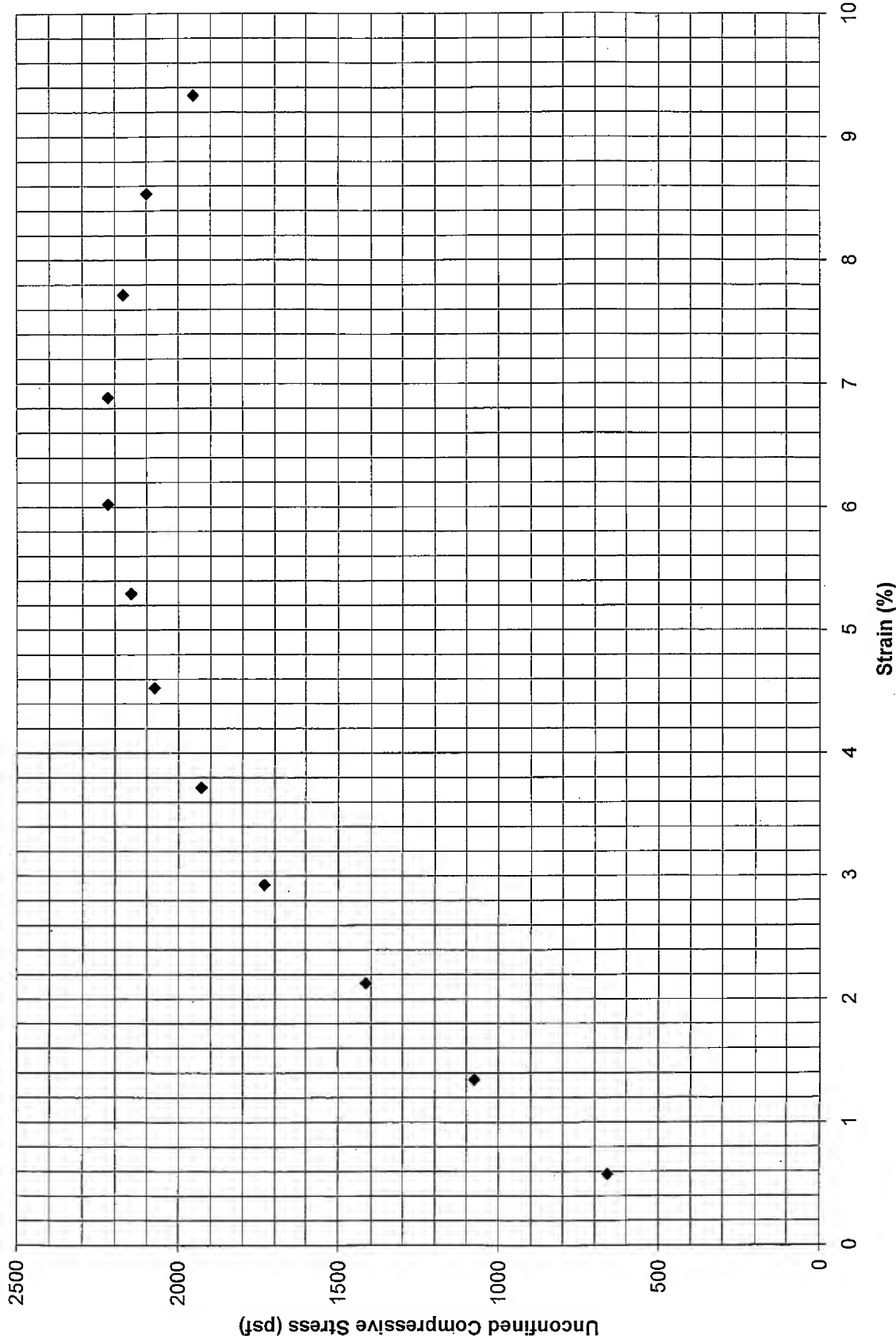
Paul C. Soltis, R.C.E. 56140, G.E. 2606
Senior Engineer

PCS/PS/eh



Patrick Sliwinski
Geotechnical Laboratory Manager

Distribution: (1) Addressee
(1) Mr. Abram Eloskof, Tetra Tech Environmental Consultants, Inc.



Sample Height = 5.875 inches
 Sample Diameter = 2.75 inches
 Dry density of sample = 113.2 pcf
 Moisture content of sample = 22.4%

TWINING
LABORATORIES
OF SOUTHERN CALIFORNIA

UNCONFINED COMPRESSIVE STRESS

Moffett Air Field
 Mountain View, California

PROJECT NO.
 050409

REPORT DATE
 JULY 2005

FIGURE 1

BORING LOGS



TETRA TECH

SUBSURFACE EXPLORATION LOG

BORING/WELL ID NUMBER: B1

CLIENT: Wony

GEOLOGIST: V. K. L.

PROJECT NUMBER: 3046 SITE 27

DATE(S) DRILLED: 5/13/05

LOCATION: Durham Chemical Basin

DRILLING COMPANY: WDC

SURFACE ELEVATION:

NORTHING:

TOTAL DEPTH:

DRILLING METHOD: HSA 8" OD-425 ID

SAMPLING METHOD: SSP + Shelby

EASTING:

Depth (ft)	Sample Recovery	Blow Counts	Sample ID	Time (24 hr)	CGI/PIID		Lithologic Contact (ft bgs)	Group Symbol	Group Name	Color	Moisture	% gravel	% sand	% non-plastic fines	% plastic fines	Grading	Plasticity (fines)	GEOLOGIC DESCRIPTION					Modifiers
					Soil (ppm)	Breathing Zone (ppm)												Angularity (sand/gravel)	Grain size range (sand)	Grain size range (gravel)	Max. grain size (gravel)		
10.5				10.5					SANDY Fd Clay 80% H.P.F. w/ 20% Fines - scattered fine gravel @ surface	Dark Grey	D		80	20		11-H					Hard Argill. 0-5' 1045-1115 Rehm - 5' @ 1122		
11.1				11.1					FAT CLAY 100% H.P.F. BLACK - MOST	Brown	M			100		H					2' SET @ 5'		
11.2				11.2																	7 WATERS' BGS		
11.25				11.25																			
11.29				11.29																			
11.30				11.30					FAT CLAY 100% H.P.F.	Brown	W			10		H					Hard @ 15" around not Pen. SHELTER TUB		
11.50				11.50																			
12.0																							
12.5																							
13.0																							
13.5																							
14.0																							
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TETRA TECH

SUBSURFACE EXPLORATION LOG

BORINGWELL ID NUMBER: B-2

CLIENT:

GEOLOGIST:

PROJECT NUMBER:

DATE(S) DRILLED:

LOCATION:

DILLING COMPANY:

SURFACE ELEVATION:

NORTHING:

TOTAL DEPTH:

DRILLING METHOD:

SAMPLING METHOD:

EASTING:

GEOLOGIC DESCRIPTION																						
Depth (ft)	Sample Recovery	Blow Counts	Sample ID	Time (24 hr)	Soil (ppm)	Breathing Zone (ppm)	Lithologic Contact (ft bgs)	Group Symbol	Group Name	Color	Moisture	> 1/4 inch	Visible - 1/4 in.	Visible with hand lens	not visible	W	high	A	V. Fine	V. Fine	Inches	Modifiers
5	3	3/6	116	1244				CH	FAT clay w/ sand - 80% n.f. Plastic fines - 20% fine sand	Light gray	W											fine nugez 0-5- H2O 3' 865 @ 1244 e.s. - 16447 TO 5'
10	1	1	116	1245				CH	FAT clay - 100% n.f. f. STICKY, SOFT MINOR VE	Light gray	M											push shelly @ 1303 - 303 - pol @ 1319 - 2' 500Y
			00 BS-07	1313					FAT clay w/ sand - 70% n.f. f. 10% f. sand - STICKY, FINE	Dark Brown	M											
				1319					TO 9' 865													

Notes: See USCS flow Charts. <5-5%=trace, 10%=few, 15-25%=little, 30-45%=some, 50+%=mostly (cobbles only)

Well Graded - 5 consecutive sieve sizes, % decreases with each decreasing particle size

Gap (Poorly) Graded - one or more particle sizes missing

Uniformly (Poorly) Graded - all particles basically same size



SUBSURFACE EXPLORATION LOG

BORING/WELL ID NUMBER: 133

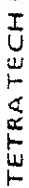
CLIENT: NAVY
PROJECT NUMBER: 3048.0001
LOCATION: Norfolk Naval Base Sigs
SURFACE ELEVATION: 27

GEOLOGIST _____
DATE(S) DRILLED _____
DRILLING COMPANY _____
NORTHING _____

TOTAL DEPTH: 9'
 DRILLING METHOD: HSA
 SAMPLING METHOD: Split Spoon / S.H.R.B.
 EASTING:

[illegible]

Well Graded : 5 consecutive sieve sizes. % decreases with each decreasing particle size
Gap (Poorly) Graded : one or more particle sizes missing



SUBSURFACE EXPLORATION LOG

BORING/WELL ID NUMBER: B-4

CLIENT:

GEOLOGIST:

PROJECT NUMBER:

DATE(S) DRILLED: 5/13/05

LOCATION:

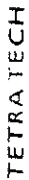
DRILLING COMPANY:

SURFACE ELEVATION:

NORTHING:

[illegible]

Well Graded - 5 consecutive sieve sizes, % decreases with each decreasing particle size
Gap (Poorly) Graded - one or more particle sizes missing
Uniformly (Poorly) Graded - all particles basically same size



SUBSURFACE EXPLORATION LOG

BORING/WELL ID NUMBER: B5

CLIENT: NAVY
PROJECT NUMBER 3048 - 0702
LOCATION: North Channel Piedesign
SURFACE ELEVATION: _____

GEOLOGIST V. R. R. R.
DATE(S) DRILLED 5/13/05
DRILLING COMPANY WDC
NORTHING.

TOTAL DEPTH: _____
 DRILLING METHOD: HSA-LAR
 SAMPLING METHOD: SPT/94SLBY
 EASTING: _____

Depth (ft)	Sample Recovery	Blow Counts	Sample ID	Time (24 hr)	CGI/PID		Lithologic Contact (ft bgs)	Group Symbol	Group Name	Color	Moisture	GEOLOGIC DESCRIPTION										Modifiers																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
					Soil (ppm)	Breathing Zone (ppm)						% gravel	% sand	% non-plastic fines	% plastic fines	Grading	Plasticity (fines)	Angularity (sand/gravel)	Grain size range (sand)	Grain size range (gravel)	Max grain size (gravel)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
5				16.9				CH	FAT clay w/ sand - 85% H.P.F. w/ 15% F sand - sticky soft.	Dark Brown	M																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															

APPENDIX G

SEDIMENT BENCH-SCALE TESTING REPORT

Ms. Anna Espinoza
TN & Associates, Inc.
317 East Main Street
Ventura, California 93001-2624

**Subject: Results of Bench Scale Testing
Moffett Air Field Project
Mountain View, California**

Dear Ms. Espinoza:

Twining Laboratories of Southern California, Inc. (Twining Laboratories) is pleased to present this report that summarizes the results of geotechnical and bench scale testing for the Moffett Air Field project in Mountain View, California. This report is provided in accordance with TN & Associates' Subcontract Number SC2005026-3770 and Modification No. 1 of the same subcontract.

PROJECT DESCRIPTION AND SCOPE OF SERVICES

Our understanding of the project is based upon the Request for Proposal (RFP) prepared by TN & Associates (TN&A) dated April 13, 2005 and upon discussions with Mr. Abram Eloskof of Tetra Tech Environmental Consultants, Inc. Fifteen tube that comprised a total of five samples containing organic sediments were delivered to Twining Laboratories on May 14, 2005. The chain-of-custody form for transmittal of the samples is included as Attachment 1. It should be noted that each sample shown on the chain-of-custody form was comprised of three tubes. TN&A requested bench scale testing on a composite sample of the fifteen tubes of organic sediments.

We understand that bench scale testing is performed for the purpose of estimating the amount of reagent (i.e., either waste lock polymer material or lime kiln dust) that will be required to mix into dredged sediment so that it can be disposed in a landfill. Bench scale testing on the fifteen tube samples of organic sediments consisted of the following:

- Obtain starting moisture content of the composite of the organic sediment samples (using a low heat, forced-air oven at approximately 100°F) and mix with varying percentages of waste lock polymer material (WLPM) or lime kiln dust (LKD), then obtain moisture content of sample after mixing;
- Perform a Paint Filter Test in accordance with EPA Test Method 9095 (see Attachment 2) on each mixed sample to determine if free liquids are present;
- Perform sieve analysis in general accordance with ASTM D 422 (with hydrometer) on a composite sample of organic sediment; and

- Perform air-drying of one sample of organic sediment and monitor moisture loss over time.

Finally, our scope of services includes the preparation of this report summarizing the results of the bench scale testing.

BENCH SCALE TESTING – ORGANIC SEDIMENTS

Bench scale testing was performed on the samples of organic sediments delivered to Twining Laboratories. The samples consisted of five sets of three 12-inch long, 2-inch diameter tubes that were sealed with end caps and duct tape. The five sets of samples (total of fifteen tubes) were combined into one composite sample. The composite sample was then split into 14 specimens for testing (12 specimens for bench scale testing, 1 specimen for sieve analysis, and 1 specimen for air-drying).

Bench scale testing consisted of mixing seven specimens with varying amounts of waste lock polymer material (WLPM) and five specimens with varying amounts of lime kiln dust (LKD). The WLPM and LKD were shipped to Twining Laboratories by Adsorption Technologies, Inc. in Wrentham, Massachusetts at the request of Mr. Abram Eloskof. A range of mixture ratios were tested to determine whether or not free liquids were present in the specimen after mixing with the reagent. The consistency of the material during mixing was also observed and recorded. After mixing the reagent into the specimen, each specimen was placed in a fine mesh paint filter and allowed to sit for 5 minutes. If no liquid passed the paint filter in 5 minutes time, the specimen was recorded as a "PASS" in Table 3 and was deemed to contain "no free liquid" in accordance with EPA Test Method 9095. If liquid did pass through the filter in the 5-minute time period, the specimen was recorded as a "FAIL" in Table 3 and was deemed to contain "free liquid." Table 1 summarizes the results of the paint filter tests performed for the bench scale testing of the organic sediments.

TABLE 1 – RESULTS OF PAINT FILTER TEST (EPA TEST METHOD 9095)

Reagent Type ¹	Amount of Reagent (% dry weight of specimen tested)	Result of Paint Filter Test (Pass or Fail)
WLPM	0.5	Fail
WLPM	0.6	Pass
WLPM	0.8	Pass
WLPM	1	Pass
WLPM	1.5	Pass
WLPM	1.75	Pass
WLPM	2	Pass
LKD	25	Fail
LKD	30	Fail
LKD	35	Fail
LKD	37	Pass
LKD	40	Pass

¹ WLPM = Waste Lock Polymer Material, LKD = Lime Kiln Dust

Prior to and after mixing, a moisture content of the material was obtained by drying a representative moisture sample in a low heat oven (approximately 100° Fahrenheit). A low heat oven was used to prevent the possible burn off of organic material and water hydrated by the reagent added. The results of the moisture contents obtained on specimens tested prior to and after mixing are presented in Table 2. Table 2 also presents the observations made regarding the consistency of the specimen after mixing.

**TABLE 2 – RESULTS OF MOISTURE CONTENTS
AND CONSISTENCY OBSERVATIONS**

Reagent Type	Amount of Reagent (% dry weight of specimen tested)	Initial Moisture Content (%)	Moisture Content After Mixing (%)	Consistency Observations
WLPM	0.5	68.0	79.1	Fluid-like, visible free water
WLPM	0.6	76.2	73.3	Slightly stiff, similar to peanut butter, visible water on surface but not releasing water
WLPM	0.8	76.0	88.5	Slightly stiff, similar to peanut butter, visible water on surface but not releasing water
WLPM	1	88.7	67.2	Stiff, slightly stiffer than peanut butter, visible water on surface but not releasing water
WLPM	1.5	85.6	72.3	Stiff, slightly stiffer than peanut butter, visible water on surface but not releasing water
WLPM	1.75	68.3	76.1	Stiff, created lumps during mixing, very little water visible at surface
WLPM	2	76.0	78.4	Very stiff, similar to Playdoh, created lumps during mixing, no water visible at surface
LKD	25	85.8	55.6	Non-fluid, slightly stiff, similar to peanut butter, very slight water visible at surface
LKD	30	87.6	56.1	Non-fluid, stiff, slightly stiffer than peanut butter, very slight water visible at surface, difficult to mix
LKD	35	78.6	53.7	Non-fluid, stiff, slightly less stiff than Playdoh, very slight water visible at surface, difficult to mix
LKD	37	83.3	48.0	Non-fluid, very stiff, similar to Playdoh, no water visible at surface, very difficult to mix
LKD	40	91.5	54.0	Non-fluid, very stiff, similar to Playdoh, no water visible at surface, very difficult to mix

¹ LL = Liquid Limit, PI = Plasticity Index

In addition to the bench scale testing, a sieve analysis with hydrometer was performed on one of the organic sediment specimens split out from the composite sample. The results of the sieve analysis performed on the representative specimen of organic sediment are presented on Figure 1.

One of the specimens split out from the composite sample of organic sediment was used to perform air-drying of the specimen. The initial moisture content of the sample was determined and the specimen was exposed to the environment and allowed to air-dry while the moisture content during the drying was monitored with time. The weather was overcast on the first day of the test. The following days of the test were sunny and relatively warm. The sample was placed in a stainless steel pan and exposed to the sunlight. The sample was weighed at selected intervals to determine the moisture loss, hence, the moisture content of the sample as it air-dried. The results of the air-drying are presented on Figure 2.

CLOSURE


Twining Laboratories appreciates the opportunity testing services for this important project. Please contact Paul Soltis at (562) 426-3355 with questions regarding this report.

Respectfully submitted,

TWINING LABORATORIES OF SOUTHERN CALIFORNIA, INC.

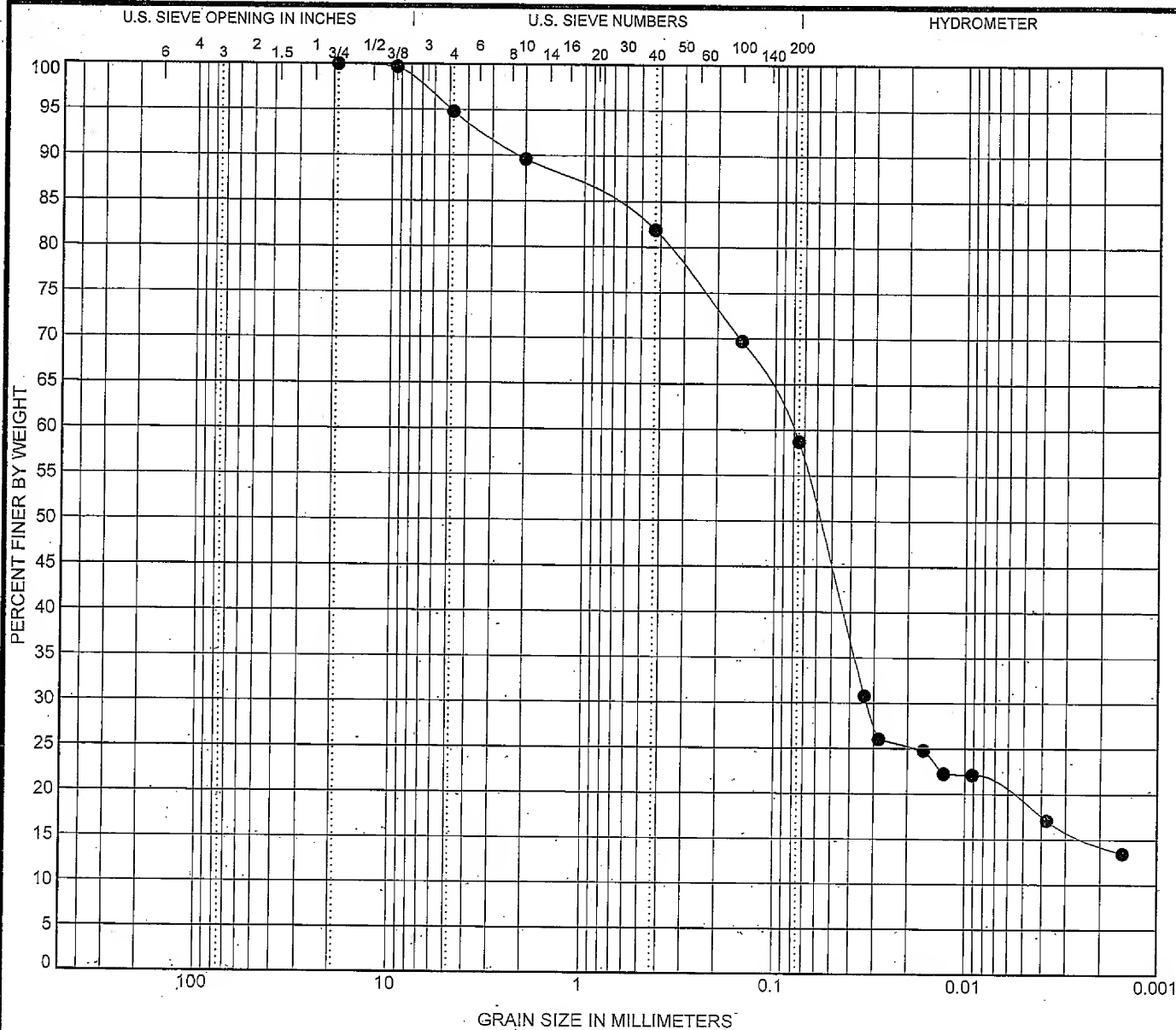


Paul C. Soltis, R.C.E. 56140, G.E. 2606
Senior Engineer


Patrick Sliwinski
Geotechnical Laboratory Manager

PS/BK/EH

Distribution: (3) Addressee
(2) Mr. Abram Eloskof, Tetra Tech Environmental Consultants, Inc.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Sample Location		U.S.C.S. Classification						Cc	Cu
● (See Below)		Sandy Organic SILT (OH)							
D ₁₀₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	%Gravel	%Sand	%Silt	%Clay	
19	0.081	0.058	0.033		5.2	36.1	40.0	18.7	

Composite of samples 02-SS-01 through 02-SS-05

TWINING
LABORATORIES
OF SOUTHERN CALIFORNIA

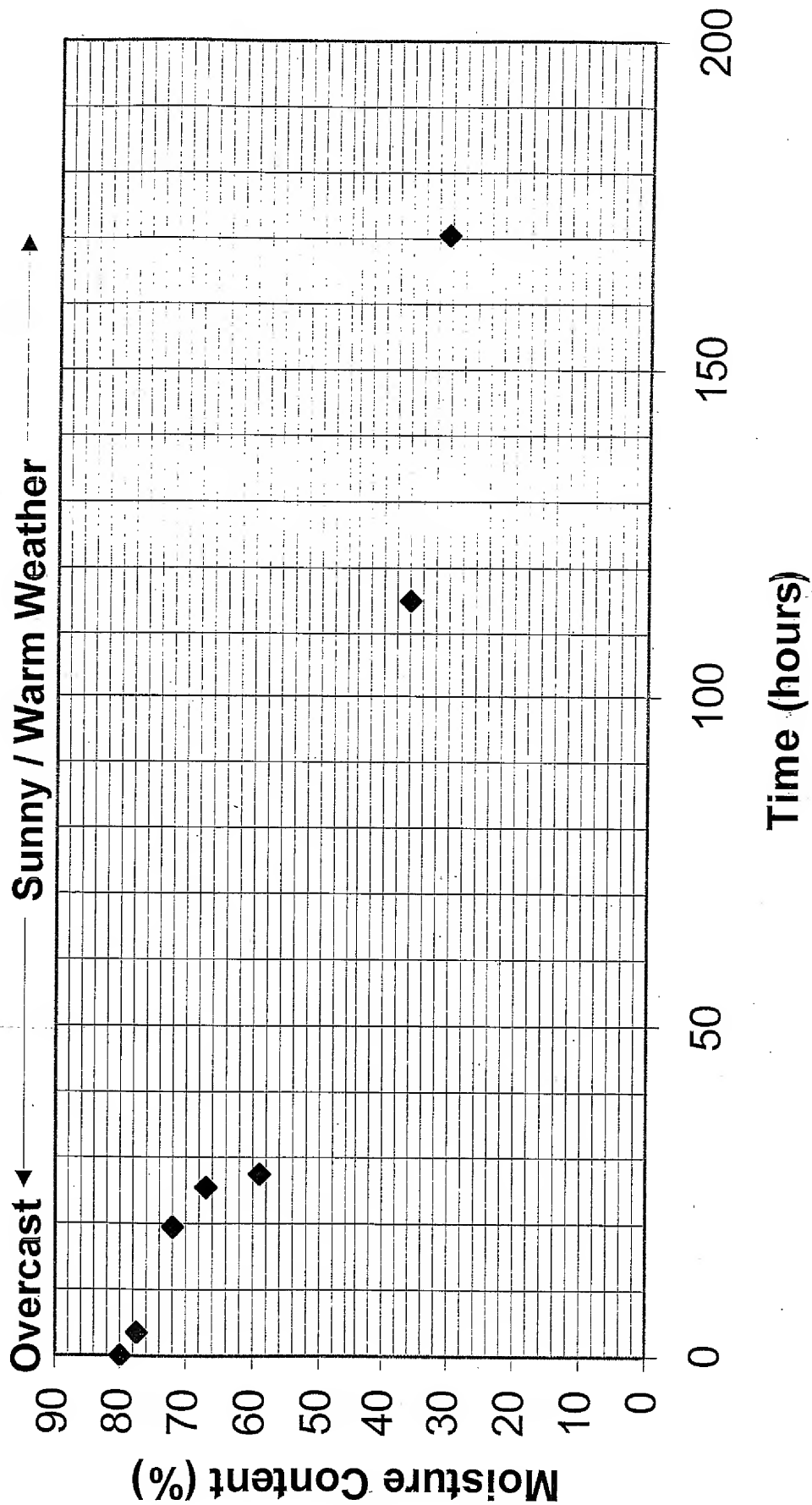
GRAIN SIZE DISTRIBUTION

Moffett Air Field
California

PROJECT NO.
050409

REPORT DATE
June 2005

FIGURE 1



TWINING
LABORATORIES
OF SOUTHERN CALIFORNIA

AIR-DRIED MOISTURE CONTENT V. TIME

Moffett Air Field
 Mountain View, California

PROJECT NO.
 050409

REPORT DATE
 JUNE 2005

FIGURE 2

CHAIN-OF-CUSTODY RECORD

ATTACHMENT 1

[illegible]

White - Laboratory; Pink - Laboratory; Canary - Project File: Manila - Data Management

METHOD 9095B

PAINT FILTER LIQUIDS TEST

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the presence of free liquids in a representative sample of waste.

1.2 The method is used to determine compliance with 40 CFR 264.314 and 265.314.

2.0 SUMMARY OF METHOD

2.1 A predetermined amount of material is placed in a paint filter. If any portion of the material passes through and drops from the filter within the 5-min test period, the material is deemed to contain free liquids.

3.0 INTERFERENCES

3.1 Filter media were observed to separate from the filter cone on exposure to alkaline materials. This development causes no problem if the sample is not disturbed.

3.2 Temperature can affect the test results if the test is performed below the freezing point of any liquid in the sample. Tests must be performed above the freezing point and can, but are not required to, exceed room temperature of 25 °C.

4.0 APPARATUS AND MATERIALS

4.1 Conical paint filter -- Mesh number 60 +/- 5% (fine meshed size). Available at local paint stores such as Sherwin-Williams and Glidden.

4.2 Glass funnel -- If the paint filter, with the waste, cannot sustain its weight on the ring stand, then a fluted glass funnel or glass funnel with a mouth large enough to allow at least 1 in. of the filter mesh to protrude should be used to support the filter. The funnel should be fluted or have a large open mouth in order to support the paint filter yet not interfere with the movement, to the graduated cylinder, of the liquid that passes through the filter mesh.

4.3 Ring stand and ring, or tripod.

4.4 Graduated cylinder or beaker -- 100-mL.

5.0 REAGENTS

5.1 None.

6.0 SAMPLE COLLECTION, PRESERVATION, AND HANDLING

A 100-mL or 100-g representative sample is required for the test. If it is not possible to obtain a sample of 100 mL or 100 g that is sufficiently representative of the waste, the analyst may use larger size samples in multiples of 100 mL or 100 g, i.e., 200, 300, 400 mL or g. However, when larger samples are used, analysts shall divide the sample into 100-mL or 100-g portions and test each portion separately. If any portion contains free liquids, the entire sample is considered to have free liquids. If the sample is measured volumetrically, then it should lack major air spaces or voids.

7.0 PROCEDURE

7.1 Assemble test apparatus as shown in Figure 1.

7.2 Place sample in the filter. A funnel may be used to provide support for the paint filter. If the sample is of such light bulk density that it overflows the filter, then the sides of the filter can be extended upward by taping filter paper to the inside of the filter and above the mesh. Settling the sample into the paint filter may be facilitated by lightly tapping the side of the filter as it is being filled.

7.3 In order to assure uniformity and standardization of the test, material such as sorbent pads or pillows which do not conform to the shape of the paint filter should be cut into small pieces and poured into the filter. Sample size reduction may be accomplished by cutting the sorbent material with scissors, shears, a knife, or other such device so as to preserve as much of the original integrity of the sorbent fabric as possible. Sorbents enclosed in a fabric should be mixed with the resultant fabric pieces. The particles to be tested should be reduced smaller than 1 cm (i.e., should be capable of passing through a 9.5 mm (0.375 inch) standard sieve). Grinding sorbent materials should be avoided as this may destroy the integrity of the sorbent and produce many "fine particles" which would normally not be present.

7.4 For brittle materials larger than 1 cm that do not conform to the filter, light crushing to reduce oversize particles is acceptable if it is not practical to cut the material. Materials such as clay, silica gel, and some polymers may fall into this category.

7.5 Allow sample to drain for 5 min into the graduated cylinder.

7.6 If any portion of the test material collects in the graduated cylinder in the 5-min period, then the material is deemed to contain free liquids for purposes of 40 CFR 264.314 and 265.314.

8.0 QUALITY CONTROL

8.1 Duplicate samples should be analyzed on a routine basis.

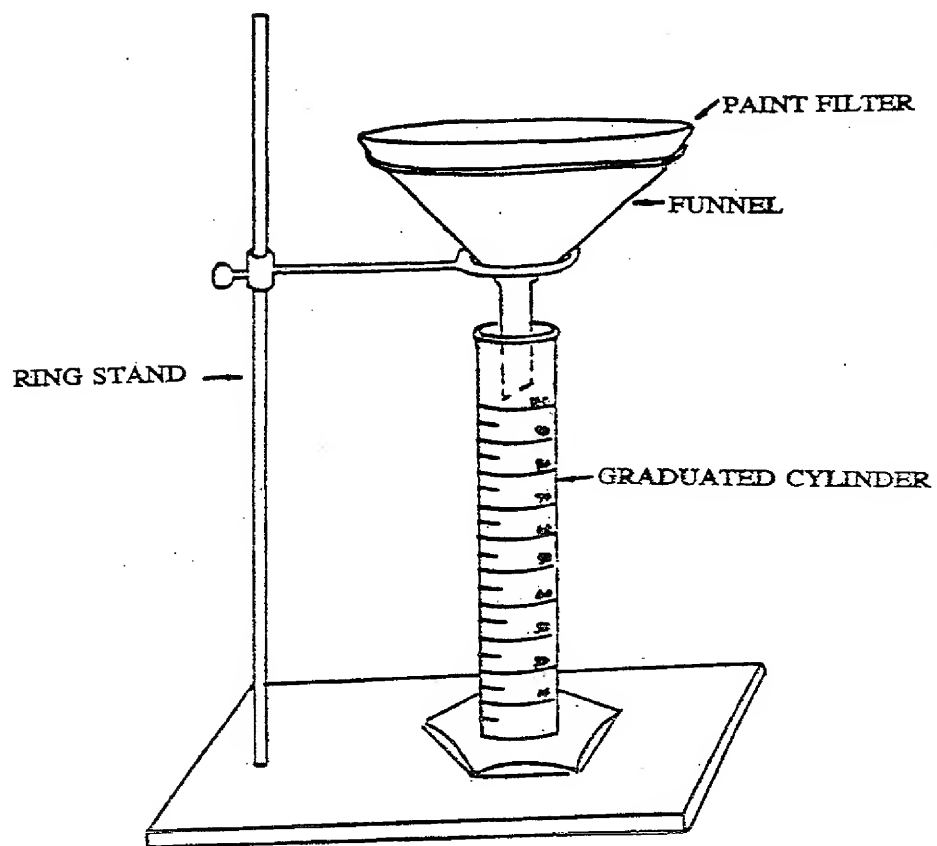
9.0 METHOD PERFORMANCE

9.1 No data provided.

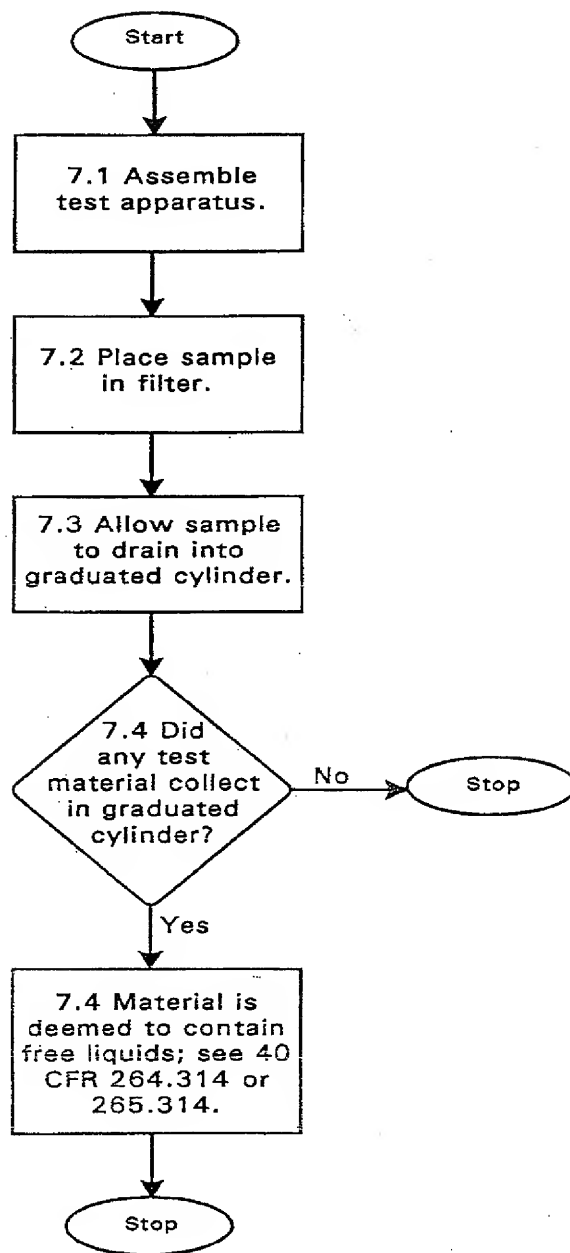
10.0 REFERENCES

10.1 None provided.

FIGURE 1
PAINT FILTER TEST APPARATUS



METHOD 9095B
PAINT FILTER LIQUIDS TEST



APPENDIX H

CALCULATIONS

H.1 DRAFT HYDROLOGY/HYDRAULIC REPORT

H.2 PUMP SIZING, VOLUME OF DITCH, VOLUME OF RETENTION BASIN, AND BERM HEIGHT

H.3 SLOPE STABILITY ANALYSES

H.4 EVALUATION OF LOCAL ROADS FOR CONSTRUCTION TRAFFIC

H.1 DRAFT HYDROLOGY/HYDRAULIC REPORT

APPENDIX H
DRAFT FINAL
HYDROLOGY/HYDRAULIC REPORT

FOR

SITE 27
FORMER NAVAL AIR STATION MOFFETT FIELD,
SANTA CLARA COUNTY, CALIFORNIA

ENVIRONMENTAL MULTIPLE AWARD CONTRACT
Contract Number N68711-04-D-1105
Contract Task Order 0002

January 13, 2006

Prepared for



Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Prepared by



317 East Main Street
Ventura, California 93001



1940 East Deere Avenue, Suite 200
Santa Ana, California 92705

APPENDIX H

DRAFT HYDROLOGY/HYDRAULIC REPORT

PURPOSE

The purpose of the hydrology/hydraulic report is to provide an engineering evaluation of the water surface runoff from the restoration project into the Northern Channel, at former Naval Air Station Moffett Field (Moffett), Moffett Field, California.

The basis of the Tetra Tech EC, Inc. (TtEC) design for the surface water flow into the Northern Channel is to have a diversion drainage system around construction restoration zones of activities. The Northern Channel restoration project needs to provide stormwater runoff control and/or retention of the 2-year, 24-hour return storm event and provide site protection with respect to the 10-year 24-hour return storm event. This report will also estimate the monthly average water retention for the construction period. This evaluation report describes the hydrology design methodology, summarizes the basis of the hydrology design, and provides analysis data input for the hydraulic design calculations of the diversion drainage conveyance system during Site 27 restoration.

DESIGN APPROACH

- Identify general drainage patterns and drainage areas.
- Identify the design storm and monthly rainfalls-storm events during restoration activities.
- Determine the average monthly rainfall runoff rate into the Northern Channel during the summer.
- Determine the 2-year and 10-year, 24-hour storm event runoff rate into the Northern Channel.
- Determine the required retention basin capacity during restoration activities.

IDENTIFY SITE DRAINAGE PATTERN

Site location, showing the general drainage pattern for the Ames Research Center (ARC) area and existing development, is provided in [Figure B.1-1](#) of the Stormwater Management Plan (SWMP).

OVERVIEW OF THE EXISTING STORM DRAINAGE SYSTEM

The existing storm drainage system for the site has been described in the National Aeronautics and Space Administration (NASA) ARC Environmental Impact Study (EIS) (NASA, 2002). A summary of the subject drainage system is reported below.

The ARC watershed consists of about 1,690 acres and is divided into two drainage areas with an additional 50 acres consisting primarily of Highway 101 right-of-way. On-site storm drain pipe sizes throughout the center range from 6 inches to 42 inches.

The first drainage system, referred to as the western drainage system, covers an area of approximately 680 acres. This drainage system services the NASA Research Park (NRP) area, most of the ARC Campus, Berry Court Military Housing, and the Bay View area.

The western drainage system discharges into the Stormwater Retention Pond, which lies north of the Bay View area and has no outfall. The western drainage area has experienced localized flooding due to inadequate system capacity.

The second drainage system, referred to as the eastern drainage system, covers an area of approximately 1,015 acres in the southwest portion of the NRP area, the ARC facilities next to the runway, the eastside/airfield, and the California Air National Guard (CANG) area. This drainage system will be the focus of Northern Channel drainage control bypass, as shown in [Figure B.1-2](#) of the SWMP. There is no direct connection between this area and the western drainage area. Local flooding has occurred in the northern part of the eastern drainage system and airfield during peak rainfall events due to the lack of adequate drainage capacity.

The eastern drainage system begins in the southern portion of ARC and the southern portion of the CANG. Two drainage structures, which serve approximately 15 acres of California Department of Transportation (Caltrans) right-of-way, discharge into the southern portion of the airfield. Stormwater from the airfield and the CANG travels north through several storm drain lines and via random overland flow. Overland flow from the northeastern portion of the airfield (currently occupied by the golf course) is collected by a small concrete-lined channel, with half of the drainage flowing toward the Moffett storm drain lift station at Building 191, which is located at the northeast corner of the airfield and half of the drainage flowing east to culverts under the North Patrol Road. This channel is commonly referred to as North Patrol Road Ditch. It is separated from the Northern Channel, which flows east, by a levee. The levee was raised to prevent flow in the Northern Channel (downstream of the lift station) from discharging into the smaller channel and flowing back into the lift station. This levee elevation during and after construction will require maintenance.

The southeastern portion of the NRP also contributes to the eastern drainage system via a main line that flows north, near the westernmost portion of the airfield. As this line continues north along Zook Road, it picks up storm discharge from several smaller lines from the eastern portion

of ARC. Just south of North Warehouse Road, the line reaches its ultimate size of 36 inches in diameter. This provides a flow capacity of about 40 cubic feet per second (cfs). However, localized flooding has resulted. The 36-inch main line turns east crossing the airfield to the Moffett storm drain lift station, which is located at the northeastern section of the airfield.

Stormwater from the 36-inch main and the North Patrol Road Ditch, along with shallow groundwater, discharges into the lift station. The lift station consists of two pumps and has a capacity of approximately 12,000 gallons per minute (gpm). Water is pumped into the Northern Channel, which flows east off of the site and runs along the northern boundary of the Lockheed site. Two 5,000-gpm portable pumps are located at intermediate points along the North Patrol Road Ditch and discharge directly into the Northern Channel. Therefore, the total peak discharge into the Northern Channel as it leaves the site is 22,000 gpm or 49 cfs. The Northern Channel connects to the easternmost Lockheed pond, adjacent to the Moffett Channel (Sunnyvale West-Side Channel), through a 48-inch-diameter culvert. A pump station with three pumps lifts the water into the Moffett Channel where it flows by gravity into San Francisco Bay.

SITE HYDROLOGY

IDENTIFY THE DESIGN STORM

The design storms for these calculations are:

- 2-year, 24-hour return storm event
- 10-year, 24-hour return storm event
- September 24-hour return storm event

Precipitation data from National Oceanic and Atmospheric Administration (NOAA) with the climatological map and data are provided in Figures 26 and 28 and the table titled "Monthly Total Rainfall at San Jose."

DETERMINE THE AVERAGE RUNOFF RATE AND RETENTION VOLUME USING RATIONAL METHOD

The Rational Method was applied to determine the average runoff rate and monthly retention volume. The method is based on the premise that runoff resulting from steady, uniformly intense precipitation will occur when the entire watershed contributes to the Northern Channel flow or required capacity. Local flooding has occurred in the northern part of the eastern drainage system and airfield during peak rainfall events due to the lack of adequate drainage capacity (NASA, 2002). Therefore, an average 24-hour dewatering rate for a 2-year return storm event will be determined to compare with the flow capacity of the existing pump system at the site. It should be noted that the 2-year return storm event has only occurred twice during the summer months in 127 years. Protection will be provided for a 10-year return period event with detention and will be dewatered within 48 hours.

Peak stormwater flow rate will be an average 24-hour runoff flow rate, based on overland flow into relatively flat grade drainage swales and with ditch retention times. It will be assumed that the base storm drain system could dewater within 24 hours to the Northern Channel pump station.

The Rational Method calculates the amount of runoff for a particular drainage area by multiplying the area by the rainfall intensity (inches/hour) and a runoff coefficient. It was modified for a 24-hour stormwater runoff flow rate into the Northern Channel. The modified Rational Method formula is as follows:

$$\text{Average 24-hour } Q = (c)(i)(A)$$

Where:

c = runoff coefficient

i = rainfall, in inches per 24-hour (x-in./24-hr = inches/hour)

A = drainage area, in acres

The runoff coefficient (c) is used to estimate the amount of runoff versus evaporation and infiltration. The runoff coefficient is dependent upon the characteristics of the drainage basin under study. Site characteristics that influence rainfall infiltration rates include soil type, soil moisture, antecedent rainfall, cover type, impervious surfaces, and surface retention. The maximum runoff coefficient is 1.0, which means that all rainfall runs off the ground surface and into the drainage system. A runoff coefficient of 0.9 to 1.0 would be applicable to a paved impervious area and water surface area. The maximum runoff coefficient from the site will be a weighted average. The runoff coefficient (c), identified in general civil engineering design manuals, was used in this hydrology report.

Time of concentration is the travel time for runoff from the most distant boundary of the watershed to the point of pump station retention. Calculations for travel time would normally be based on slope, length of flow path, depth of flow, drainage restrictions, and roughness of flow surfaces. However, this travel time will be assumed to be a 24-hour period. The 24-hour cumulative value for the rainfall in that period from the design storm will be averaged out for the time of concentration (i) input into the Rational Method equation. This 24-hour time rainfall period will be used for site drainage and basin capacity calculations.

The general area of hydrology runoff will include 200 acres of native grassy undeveloped land; 600 acres of mowed grass ground cover, which includes golf course and general site landscaped areas; and 200 acres of developed impervious surface cover, which includes airfield pavement, roads, parking areas, and buildings. An additional 15 acres of run-on from the Caltrans easement will be considered to be 50 percent impervious and 50 percent mowed grass ground cover. The total hydrological drainage area evaluated does not show and will not include the developed area retention times, detention basin, or run-on from the public street or drainage system backup, but will assume that these areas are able to dewater within 24 hours. The boundary of the watershed to the point of inlet pump station into the North Channel is shown in [Figure B.1-1](#) of the SWMP.

SITE HYDROLOGY

RATIONAL METHOD $Q = CIA$

A. "C" VALUE

PRE- & PRESENT CONDITION: Reference: General Civil Eng Handbook

Cultivated grass & native vegetation area $C = 0.45$ (Area 800 acres)

Paved Surface (Impervious surface) $C = 0.90$ (Area 200 acres)
30% gravel shoulder area along roads

Caltrans Easement (weighted average $C = 0.65$ (Area 15 acres)

Weighted average $C = \frac{(0.45 \times 800) + (0.90 \times 200) + (0.65 \times 15)}{1015} = 0.54$

Will review design for $C = 0.55$ (conservative)

"T" VALUE

Reference: NOAA - 24-hour rainfall

2-year return $T_c = 24$ -hour = 2.0 in./24hr.

10-year return $T_c = 24$ -hour = 3.0 in./24hr.

Average summer Total rainfall June-Sept = .40 inches

Month rainfall June = 0.10 inches
 July = 0.02 inches
 August = 0.05 inches

Highest Month September = 0.23 inches

B. AREA

$A = 1015$ -acres Scaled from [Figure B.1-1](#) of the SWMP

C. RATIONAL METHOD RUNOFF

2-year, 24-hour return period $CIA = Q$

$$\begin{array}{lcl} \text{2-year return} & \frac{C}{(0.55)} \times \frac{I}{(2.0/(12)/(24 \times 60 \times 60))} \times \frac{A}{(1015 \times 43560)} = & Q \\ & & = 47 \text{ cfs} \end{array}$$

$$\begin{array}{lcl} \text{10-year return} & (0.55) \times (3.0/(12)/(24 \times 60 \times 60)) \times (1015 \times 43560) = & 70 \text{ cfs} \end{array}$$

D. RAINFALL RETENTION VOLUME RUNOFF

$$\text{Average summer total} \quad (0.55) \times (0.40/12) \times (1015) = 18.6 \text{ acre-feet} = 810,000 \text{ cfs}$$

$$\begin{array}{lcl} \text{Average highest summer} & (0.55) \times (0.23/12) \times (1015) = 10.7 \text{ acre-feet} = & 466,000 \text{ cfs} \\ \text{month (September) rainfall} & \text{Assuming the average September rainfall was in one 24-} & \\ & \text{hour period } Q = 466,000 \text{ cfs}/(24 \text{ hr} \times 3600 \text{ sec/hr}) = & 5.4 \text{ cfs} \end{array}$$

CONCLUSION

The 2-year, 24-hour return storm average flow rate into the Northern Channel is calculated to be 47 cfs. The 10-year, 24-hour return storm average flow rate into the Northern Channel is calculated to be 70 cfs.

The average summer total rainfall runoff for the months June through September would be 18.6 acre-feet. The wettest summer month would be September in which an average accumulative rainfall would be 0.23 inches, which would produce 10.7 acre-feet of stormwater runoff with an average flow rate of 5.4 cfs.

SUMMARY EVALUATION

The NASA ARC EIS (NASA, 2002) reported that the total peak discharge into the Northern Channel as it leaves the site is 22,000 gpm or 49 cfs. This would compare to a 2-year, 24-hour level of protection calculated above as 47 cfs. (The 2-year return storm event has only occurred twice during the summer months in 127 years.)

Since the maximum level of site protection provided by the existing Northern Channel pump system is a 2-year, 24-hour storm event, larger storm events would require retention and have been noted in the NASA ARC EIS (NASA, 2002) as local flooding. On-site stormwater retention for the 10-year level of protection is assumed to be currently provided in the existing drainage system. The existing Northern Channel pump system can dewater the 10-year return storm event within 48 hours.

If it was assumed that average September accumulative rainfall accrued in a 24-hour storm event, the average flow rate into the Northern Channel would be 5.4 cfs, not including groundwater infiltration base flow rate. The Feasibility Study (FS) (Tetra Tech EM, Inc., 2003) indicated that the groundwater infiltration flow rate was 6,000 gallons per day (gpd) or less than 0.01cfs. A temporary bypass system during construction should at a minimum accommodate for the 5.5-cfs pumping rate in addition to any baseline flow rate from the Building 191 lift station. The bypass system should also have the ability to allow for the 2-year flow rate of 47 cfs if retention volume cannot be provided.

SITE HYDRAULICS

Stormwater from a 36-inch main and the North Patrol Road Ditch, along with shallow groundwater, discharges into the Northern Channel lift station (Building 191). The lift station consists of two pumps and has a capacity of approximately 12,000 gpm. Two 5,000-gpm portable pumps are located at intermediate points along the North Patrol Road Ditch and discharge directly into the Northern Channel. Therefore, the total peak discharge into the Northern Channel as it leaves the site is 22,000 gpm or 49 cfs. The Northern Channel connects to the easternmost Lockheed pond, adjacent to the Moffett Channel (Sunnyvale West-Side Channel), through a 48-inch-diameter culvert. A pump station with three pumps lifts the water into the Moffett Channel where it flows by gravity into San Francisco Bay. This pump station has a total capacity of 31,000 gpm or 69 cfs.

During the summer months, the flow from a summer storm event should have a bypass pumping rate of 5.5 cfs, as identified in the summary evaluation of the hydrology section above. Currently, the Northern Channel was observed during the field investigation to have a dry weather base flow rate of approximately 3 cfs. The base flow rate was identified during the field investigation by the pump discharge rate at Building 191 during dry weather conditions and checked by the weir approximation method at the pier bridge. It was also measured during a site survey and noted that a small tidal influence of approximately 1 inch does accrue.

DETERMINE THE REQUIRED CAPACITY FOR THE DRAINAGE CONTROL BYPASS SYSTEM

The Northern Channel baseline flow will be assumed to require a bypass flow of 3 cfs during dry weather conditions and 5.5 cfs during a summer storm event. In the event of a large storm event or a wet season storm event, a bypass flow of 47 cfs should be available and/or retention capabilities should be provided.

The Manning's Equation was used for open water flow and culvert pipe capacity. The Hasen-Williams equation was used for closed conduit pipe for determining head losses or pressure drops. The hydraulic calculation review was generated by the Haestad Methods Computer Program (Flowmaster) for capacity check.

HYDRAULICS

The following two scenarios were evaluated:

- Temporary bypass line with pump – an analysis of 5.5-cfs and 3-cfs flow through 1,200 feet of steel pipe (rain-for-rent) was performed.

- Temporary bypass line without pump – an analysis of 5.5-cfs and 3-cfs flow through 1,200 feet of steel pipe with 2 feet of headwater (inverted siphon/straight pipe through cofferdam liner; liner pipe boot connection with gate valve) was performed.

The findings were as follows for the temporary bypass with pump:

- 10-inch line with 50-foot pumping head will provide 5.5-cfs flow rate.
- 8-inch line with 50-foot pumping head will provide baseline flow rate of 3 cfs.

See the Worksheet for Pressure Pipe for graphical results.

The findings were as follows for the temporary bypass without pump:

- 18-inch line will handle 5.5-cfs flow.
- 12-inch line will provide a flow rate of 3 cfs.

See Plotted Curves for Pressure Pipe for graphical results.

SUMMARY EVALUATION

Recommended options:

- 1) A 10-inch straight section pipe through the cofferdam liner system in the construction zone and an 8-inch quick connect line with a stand-by pump that would provide 50 feet of pumping head
- 2) Two 8-inch quick connect lines with one pump in operating condition for the baseline flow rate of 3 cfs and a second one on stand-by to handle a wet summer storm event
- 3) During a major storm event, provide stormwater retention in Marriage Road Ditch and North Patrol Road Ditch with a backup pumping system for 48-hour dewatering

ADDITIONAL HYDRAULIC CALCULATIONS

The following additional calculations were performed:

- Determination of the volume of the detention basin (located adjacent to the stockpile area)
- Determination of the pump specifications for 12-hour dewatering of the detention basin
- Determination of the retention volume of North Patrol Road Ditch and Marriage Road Ditch
- Determination of the minimum height of a secondary containment berm for the Equipment Storage Area (located adjacent to the stockpile area)

Volume of the Detention Basin

The detention basin is shown in plan view on [Drawing C-4](#) of the drawing package in Appendix I of the Remedial Design Report. The detention basin is triangular in shape with a height of 110 feet and a base of 100 feet. The depth is approximately 6 feet, with 1 foot of freeboard. The slope of the embankment is 1 to 2.5.

Based on these dimensions and parameters, the volume was calculated to be approximately 24,000 cubic feet (180,000 gallons). The detailed calculation is attached.

Additionally, another calculation was performed to determine if the detention basin has the capacity to retain the storm runoff from the four construction pads (Pad 1-A, Pad 1-B, Pad II-A, and Pad II-B, [Drawing C-4](#) in Appendix I of the Remedial Design Report) for a 10-year 24-hour storm event.

The storm runoff from the pads for a 10-year, 24-hour storm is approximately 10,000 cubic feet. Therefore, the detention basin has the required capacity. The detailed calculation is attached.

Pump Specifications for 12-hour Dewatering of the Detention Basin

Pressure loss calculations were performed to aid in the selection of a pump that can dewater the detention basin (180,000 gallons) in 12 hours and transfer the water to Baker tanks located at the Equipment Storage Area (refer to [Drawing C-4](#) in Appendix I of the Remedial Design Report for the layout and location of the detention basin and the equipment storage area). A 6-inch-diameter high-density polyethylene pipe was assumed with an elevation head of 16 feet (bottom of detention basin, -6 feet, to the top of a Baker tank, +10 feet).

Based on the above parameters and using the Blasius Equation and Colebrook Equation for determination of friction factor, the required pumping head is 17.5 feet. Therefore, a pump operating at 250 gpm providing approximately 20 feet of head is required. The detailed calculation is attached.

Determination of the Retention Volume of North Patrol Road Ditch and Marriage Road Ditch

The retention volume of the ditches was calculated by multiplying the length of the ditches by the representative cross-sectional area of each ditch. The representative cross-sectional area for each ditch was determined by averaging the areas of ditch cross sections that were surveyed along the lengths of the ditches. [Drawing C-18](#) in Appendix I of the Remedial Design Report depicts three surveyed cross sections of North Patrol Road Ditch; [Drawing C-15](#) in Appendix I of the Remedial Design Report depicts three surveyed cross sections of Marriage Road Ditch.

Using this method, the retention volume of North Patrol Road Ditch was calculated to be 1,250,000 cubic feet; the retention volume of Marriage Road Ditch was calculated to be 140,000 cubic feet. The combined retention capacity of the two ditches is 1,400,000 cubic feet.

The combined retention capacity is sufficient to retain the storm runoff from an average September 24-hour storm event. The detailed calculations are attached.

Determination of the Minimum Height of a Secondary Containment Berm for the Equipment Storage Area

The secondary containment berm around the equipment storage area was calculated to retain the volume of one Baker tank (21,000 gallons), the runoff from a 10-year, 24-hour storm event (3 inches in 24 hours) with 5 inches of freeboard. The layout of the equipment storage area is shown on [Drawing C-4](#) in Appendix I of the Remedial Design Report.

Based on these criteria, the height of the berm is 12 inches.

REFERENCES

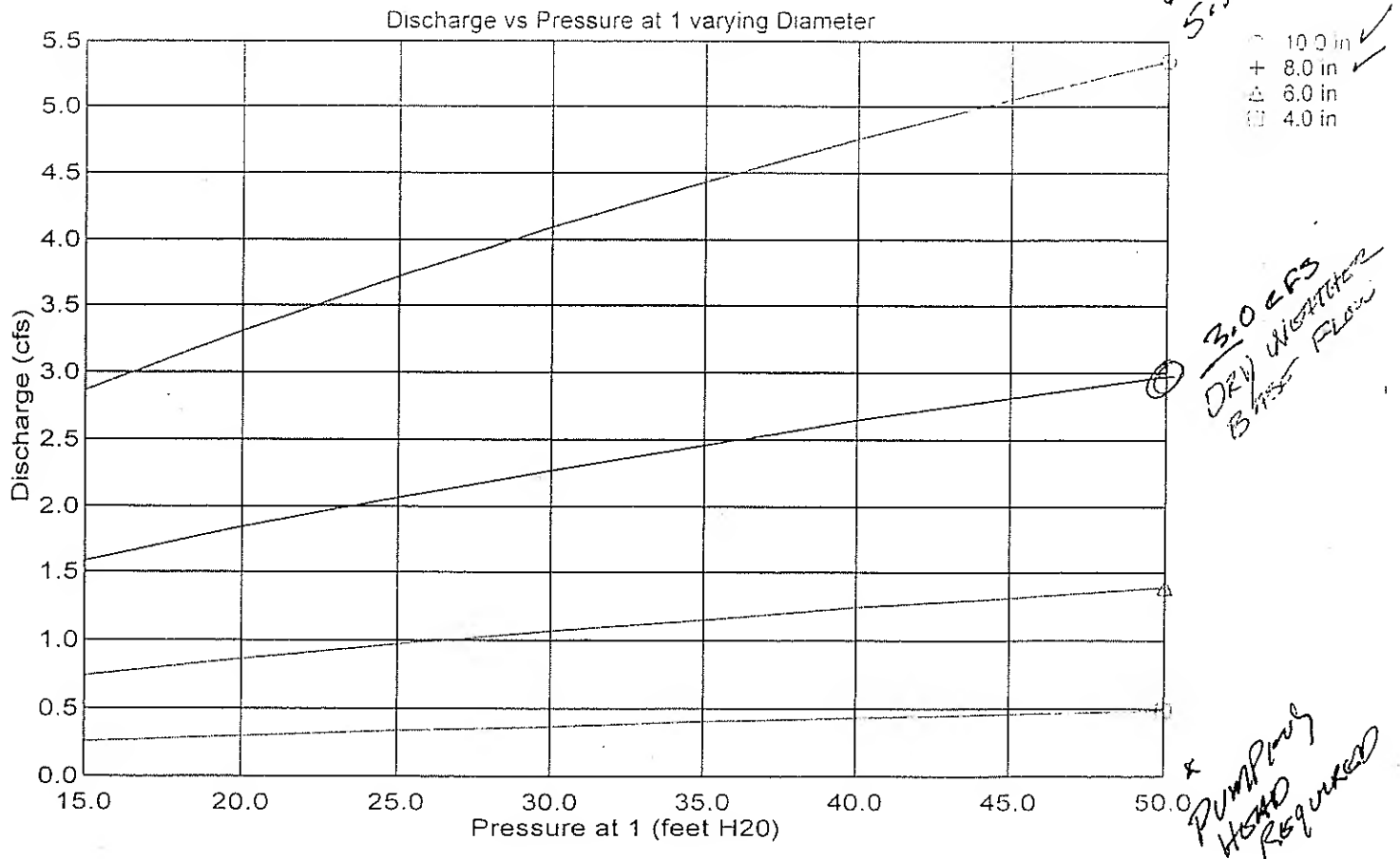
- National Aeronautics and Space Administration (NASA). 2002. *Final Programmatic Environmental Impact Statement*. NASA AMES Development Plan. July.
- Tetra Tech EM, Inc. 2003. *Final Northern Channel Feasibility Study (Site 27), Former Naval Air Station Moffett Field, Santa Clara County, California*. November.

Curve Plotted Curves for Pressure Pipe

Project Description	
Project File	c:\mikes engineering stuff\engineering\flowmast\haestad\fmw\site 27-.fm2
Worksheet	dry season by-pass line @ 5.5 cfs
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Constant Data	
Pressure at 2	0.00 psi
Elevation at 1	1.00 ft
Elevation at 2	0.00 ft
Length	1,200.00 ft
C Coefficient	110.0

Input Data			
	Minimum	Maximum	Increment
Pressure at 1	15.00	50.00	5.00 feet H2O
Diameter	4.00	10.00	2.00 in



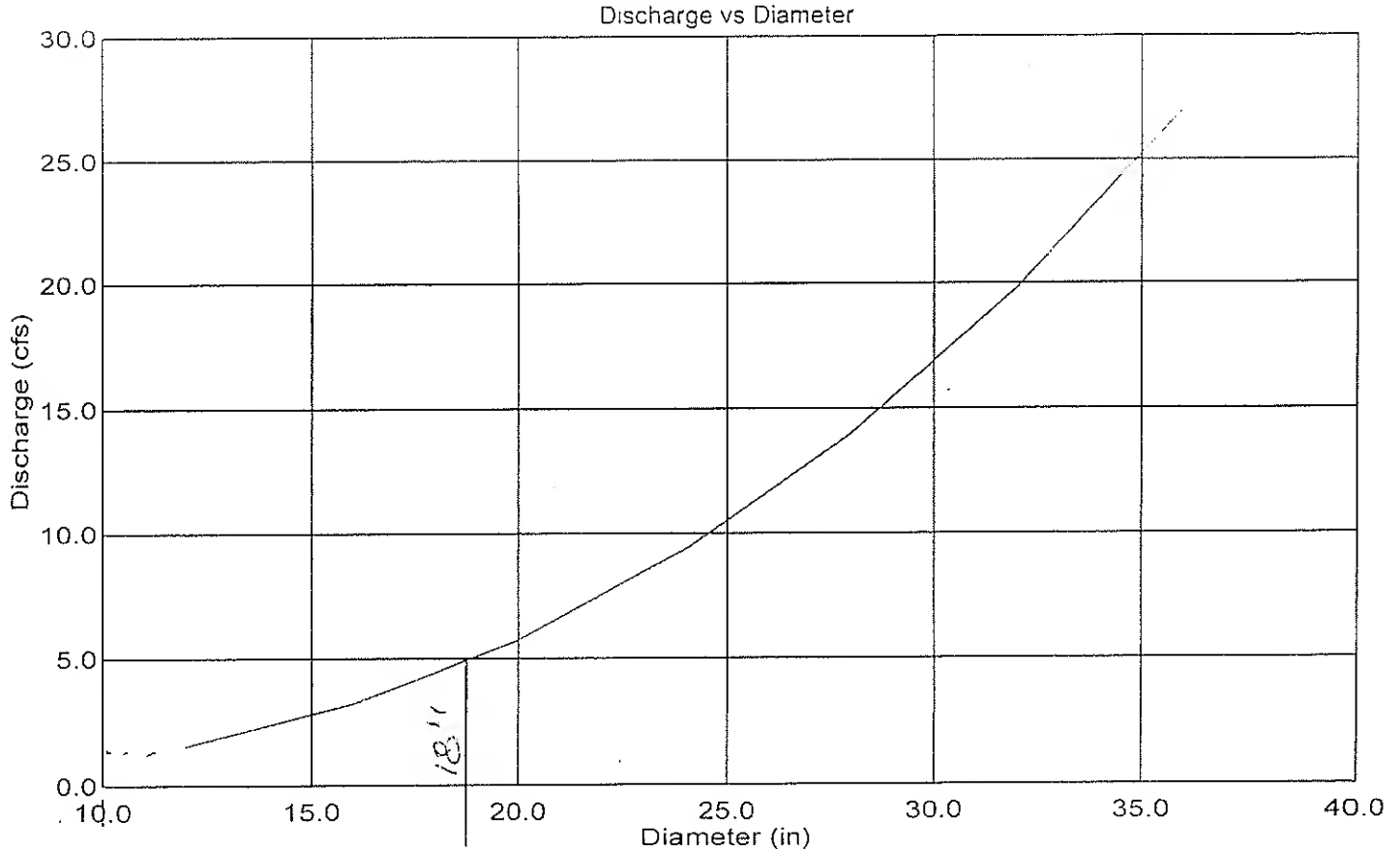
Curve Plotted Curves for Pressure Pipe

Project Description	
Project File	
Worksheet	dry season by-pass line @ 5.5 cfs
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

INVERTED SIPHON / STRAIGHT PIPE THROUGH COFFERDAM LINER

Constant Data	
Pressure at 1	0.00 feet H2O
Pressure at 2	0.00 psi
Elevation at 1	2.00 ft
Elevation at 2	0.00 ft
Length	1,200.00 ft
C Coefficient	110.0

Input Data			
	Minimum	Maximum	Increment
Diameter	12.00	36.00	4.00 in

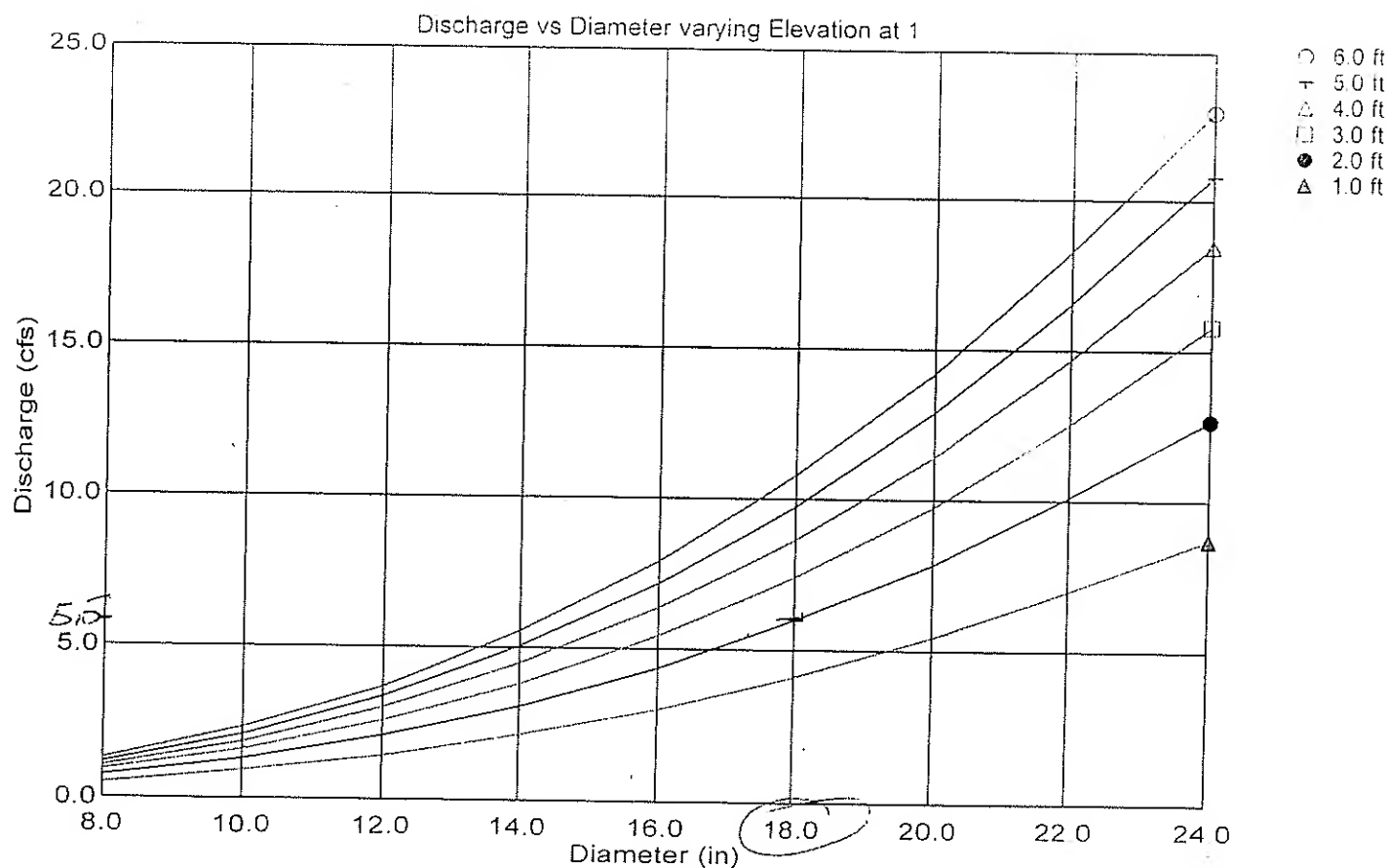


Curve Plotted Curves for Pressure Pipe

Project Description	
Project File	c:\mikes engineering stuff\engineering\flowmast\haestad\fmw\site 27-.fm2
Worksheet	dry season by-pass line @ 5.5 cfs
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Constant Data	
Pressure at 1	0.00 feet H2O
Pressure at 2	0.00 psi
Elevation at 2	0.00 ft
Length	1,200.00 ft
C Coefficient	150.0

Input Data			
	Minimum	Maximum	Increment
Diameter	8.00	24.00	2.00 in
Elevation at 1	1.00	6.00	1.00 ft



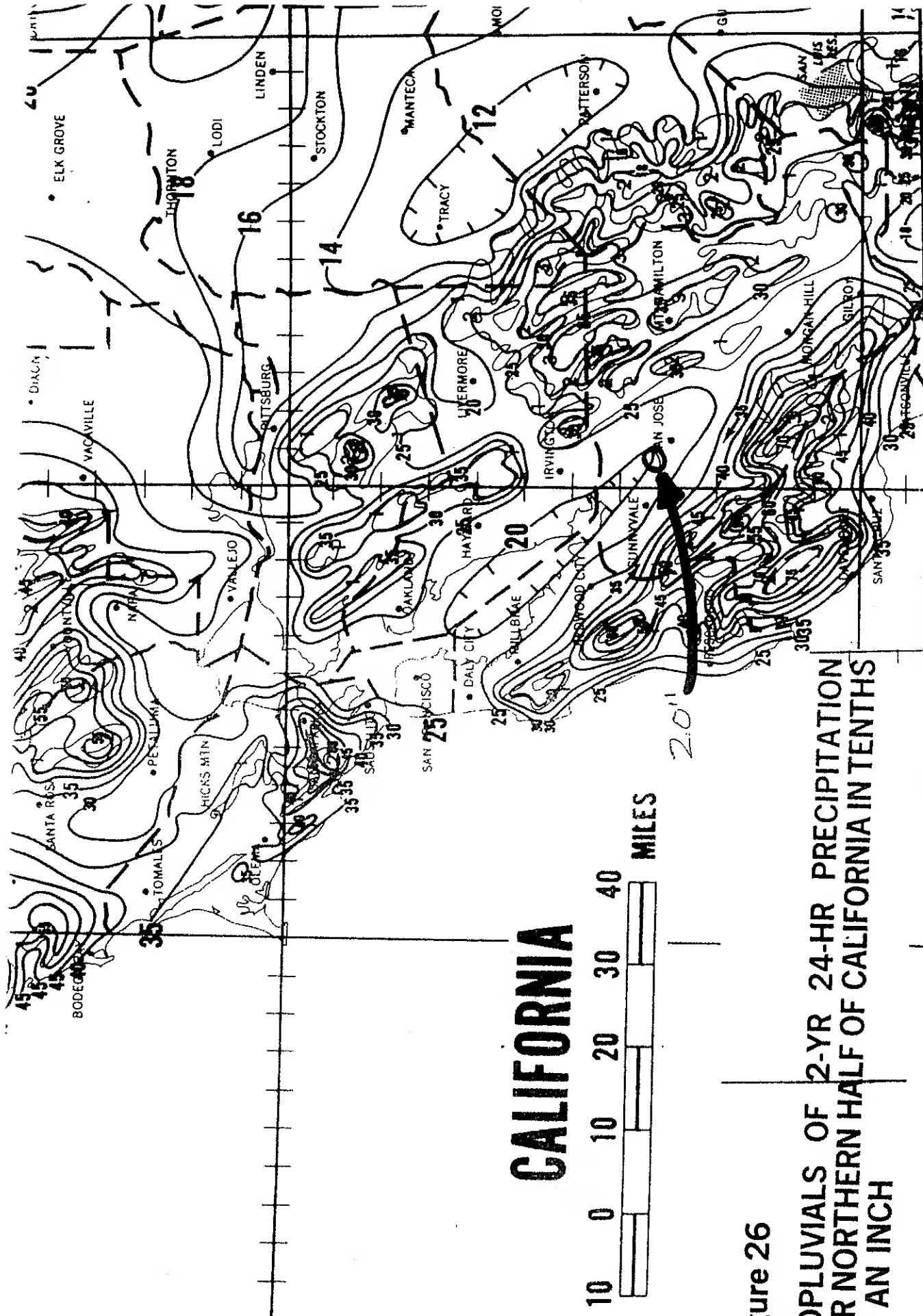
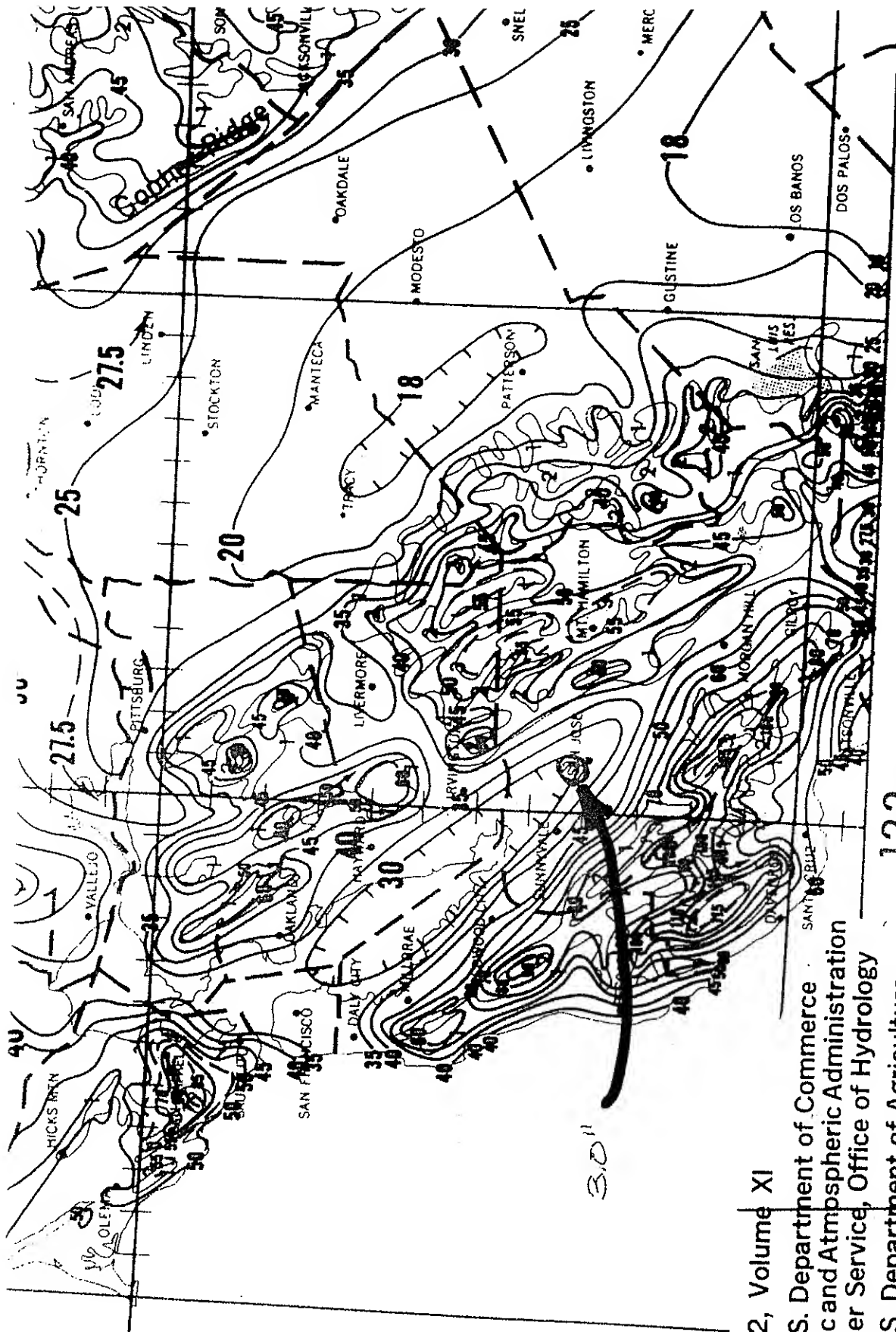


Figure 26
ISOPLUVIALS OF 2-YR 24-HR PRECIPITATION
FOR NORTHERN HALF OF CALIFORNIA IN TENTHS
OF AN INCH



NOAA ATLAS 2, Volume XI

Prepared by U.S. Department of Commerce
 National Oceanic and Atmospheric Administration
 National Weather Service, Office of Hydrology
 Prepared for U.S. Department of Agriculture,
 Soil Conservation Service, Engineering Division

Figure 28

ISOPLUVIALS OF 10-YR 24-HR PRECIPITATION
 FOR NORTHERN HALF OF CALIFORNIA IN TENTHS
 OF AN INCH

CALIFORNIA

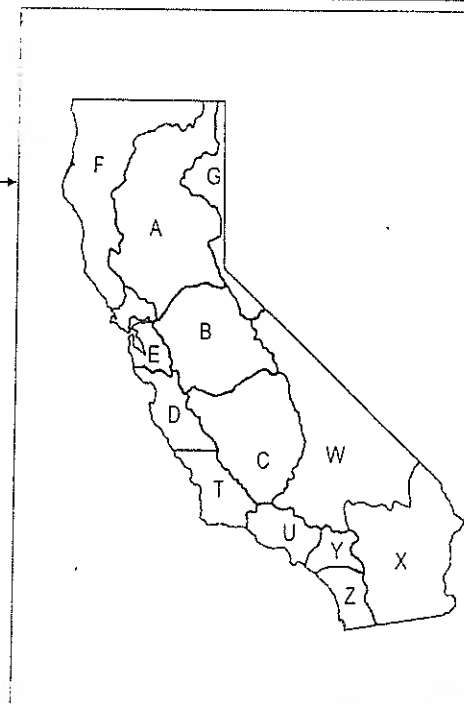


2 Maximum Daily Rainfall by Month in California													
Water Yearly shed Max	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
A 17.60	12.70 Tumble Cr 1969/73	17.60 Four Trees 1986/17	9.16 Hrsh Creek 1940/	14.70 Mt Saint Helen 1880/20	8.93 Kennes 1915/10	5.83 Furn Ridge 1982/18	5.96 Whiskeytown 1974/9	8.80 Redding 2W 1976/15	11.25 Tumble Cr 1959/19	11.82 Forbestown 1973/12	10.50 Downsville 1973/12	15.74 Lake Shore 1955/20	
B 10.80	10.80 SEntYosemite 1963/71	10.07 Cherry Valley 1963/71	7.50 Salt Sp PH 1928/	5.70 SEntYosemite 1958/71	5.11 Camp Pardee 1906/16	2.70 Long Barn 1913/71	3.14 Tiger Cr PH 1974/9	2.39 Kerlinger 1968/22	5.57 Cherry Valley 1959/19	5.14 Summerdale 1980/3	9.41 Wawona 1950/7	9.72 SEntYosemite 1955/23	
C 17.00	11.15 Giant Forest 1943/21	11.30 Hockett Mea 1982/21	7.76 Camp Wishon 1943/8	4.89 Giant Forest 1958/71	6.32 Giant Forest 1957/19	3.04 Giant Forest 1929/15	2.80 Telachap 1917/21	2.07 Telachap 1911/12	5.25 Glennville 1976/30	3.70 Visalia 1974/27	13.16 Giant Forest 1950/16	17.00 Hockett Mea 1966/6	
D 15.20	15.20 Ben Lomond 1943/71	11.76 Ben Lomond 1943/71	7.04 Ben Lomond 1904/	5.75 Ben Lomond 1943/71	4.47 Ben Lomond 1957/18	2.89 Ben Lomond 1899/	2.51 Santa Cruz 1974/9	1.42 Big Sur 1976/19	11.86 Boulder Creek 1959/18	14.11 Boulder Creek 1962/12	11.94 Freedom 1950/	12.01 Los Gatos 4W 1955/23	
E 15.28	11.56 Kenfield 1967/21	15.28 Atlas Road 1986/17	10.45 Lagunitas L 1879/3	14.70 Mt St Helena 1884/20	4.16 Pilarcos 1957/	2.65 Pilarcos 1884/	2.45 Kenfield 1974/8	4.28 St Helena 4 SW 1944/20	8.75 Wrights 1918/11	17.79 Wrights 1962/12	9.31 Pilarcos 1974/	13.63 San Andreas L 1871/19	
F 24.23	24.23 Bear Basin 1980/11	8.76 Bear Basin 1982/2	6.00 Ship Mt 1985/26	6.90 Upper Mantle 1963/12	5.97 Fort Dick 1936/	4.87 Crescent City 1920/7	5.72 Crescent City 1947/26	5.95 Shedler Cove A 1983/70	7.35 Casadero 1959/18	11.50 Onck 1950/15	18.02 Fort Ross 1874/12	17.45 Wilder Ridge 1991/5	
G 8.76	8.76 Meyers 4W 1963/	DL Bliss SP 1963/1	Boca 1907/20	Truckee 1945/17	Milford 1949/13	4.50 Meyers 4W 1963/17	3.51 Squaw Valley 1974/9	2.78 Boca 1961/8	2.60 Woodfords 1959/18	4.70 Susanville 1962/11	4.70 Markleysville 1950/17	7.60 Meyers 4W 1964/	
T 16.00	16.00 Juncal Dam 1978/10	11.94 Juncal Dam 1969/25	10.50 Lewis Rd 1983/1	4.88 Juncal Dam 1958/3	4.11 Santa Margarit 1986/	1.71 Santa Ynez 1934/4	1.30 Santa Ynez 1950/9	1.50 Monroe Bay 1976/	6.16 Pinecrest 1904/21	2.97 San Luis Obispo 1926/25	6.52 Gibraltar 1966/7	10.45 York Winery 1966/6	
U 26.12	26.12 Hoeges 1943/23	14.80 Santa Anita D 1943/23	15.96 Opids Camp 1917/2	12.74 Haines Cyn L 1944/4	5.69 Mt Wilson 1923/21	2.08 Action 1925/29	1.15 Kingston 1927/26	3.46 Chatsworth 1977/17	9.02 MTL Wilson 1939/25	6.75 Avalon 1941/22	6.96 Hoeges 1966/7	15.46 Edison Intake 1921/20	
W 17.61	16.81 Squirrel Inn 1916/17	14.00 East Pine Flat 1944/	17.61 L Arrowhead 1938/2	9.05 Squirrel Inn 1926/15	4.05 Squirrel Inn 1921/21	3.10 Squirrel Inn 1925/7	8.25 Chatsworth FI 1955/19	5.02 Wildrose RS 1984/15	8.00 Squirrel Inn 1938/25	7.35 East Pine Flat 1934/18	9.94 C Independence Sky Forest Neff 1970/	14.11 1966/6	
X 13.50	11.50 Raywood 1943/	13.50 Raywood 1938/2	7.50 Raywood 1938/2	7.50 Raywood 1926/5	4.37 Raywood 1977/	1.90 Amos 1925/30	5.66 Mitchell Cavern 1984/27	5.74 Haystack 1983/17	6.52 Raywood 1976/	3.00 Raywood 1987/	9.50 Snow Cr Upper 1965/23	11.60 Raywood 1921/18	
Y 24.92	24.92 Lytle Creek 1969/25	16.10 Big Bear L Dan 1991/	15.06 Big Bear L Dan 1938/2	6.50 Lytle Creek 1935/8	5.70 Big Bear L Dan 1897/	1.63 Seven Oaks 1912/7	3.90 Seven Oaks 1916/19	3.80 Seven Oaks 1958/	13.08 Kelley's Kamp 1918/25	6.37 Lytle Creek 1974/	12.40 Big Bear L Dan 1965/23	15.15 Baldy Netch 1974/23	
Z 16.10	11.24 Nehalem 1911/17	14.18 Nehalem 1927/16	8.83 Nehalem 1904/23	5.33 Nehalem 1927/16	3.69 Nehalem 1977/	2.23 Columbia 1899/1	7.10 Columbia 1922/18	16.10 Columbia 1891/12	15.40 Palm Springs 1926/11	7.38 Palm Springs 1889/12	19.65 Palm Springs 1965/23	19.65 Palm Springs 1965/20	
Max 26.12	26.12	18.60	17.61	14.70	8.93	5.83	8.25	16.10	13.08	14.11	18.02	17.45	

The column labeled Watershed refer to the regions shown on this map.

This tabulation of rainfall extremes is based on a small sample of the available records. When readers find omissions or corrections to this data set, please send them to:

Jim Goodridge
Box 750
Mendocino CA 95460
707 937 4709
jdg@mcn.org



Monthly Total Rainfall at San Jose

DWR # E60 7821 00

Data From : Climatological Data, City of San Jose

Latitude 37.342°

Longitude -121.903°

Elevation 95 Feet

Year	Sum	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1874	7.39				2.61	0.77	2.83	0.87	0.21	0.00	0.00	0.00	0.10
1875	7.80	1.81	1.91	0.08	2.75	0.41	0.39	0.00	0.00	0.45	0.00	0.00	0.00
1876	19.59	0.00	6.10	2.12	4.08	3.41	3.11	0.41	0.25	0.00	0.00	0.00	0.11
1877	4.72	1.17	0.01	0.00	2.23	0.48	0.78	0.00	0.05	0.00	0.00	0.00	0.00
1878	19.76	0.37	0.85	1.87	5.53	6.94	2.22	1.48	0.02	0.00	0.00	0.00	0.48
1879	15.92	0.80	0.76	0.97	1.48	3.18	5.85	1.24	1.58	0.06	0.00	0.00	0.00
1880	13.80	0.87	1.79	2.99	1.52	1.34	0.96	3.66	0.67	0.00	0.00	0.00	0.00
1881	12.46	0.00	0.49	5.60	2.12	2.04	0.80	1.28	0.00	0.12	0.00	0.00	0.02
1882	11.77	0.45	0.88	1.83	1.17	1.49	4.26	1.10	0.55	0.00	0.00	0.00	0.04
1883	11.44	0.87	1.32	0.82	1.86	0.94	2.70	0.66	2.18	0.00	0.00	0.00	0.09
1884	20.07	0.67	0.28	0.37	3.18	3.68	6.23	3.38	0.05	2.15	0.00	0.00	0.08
1885	11.19	1.50	0.06	3.90	1.83	0.18	0.86	2.75	0.11	0.00	0.00	0.00	0.00
1886	20.63	0.06	7.39	2.11	3.59	1.12	1.89	4.47	0.00	0.00	0.00	0.00	0.00
1887	11.96	0.49	0.73	0.71	0.68	6.81	0.63	1.28	0.00	0.00	0.02	0.00	0.61
1888	12.14	0.03	0.70	2.53	3.06	1.09	3.00	0.31	0.60	0.22	0.00	0.00	0.60
1889	15.11	0.00	3.88	2.44	0.50	0.70	5.80	0.79	0.96	0.04	0.00	0.00	0.00
1890	30.35	4.48	1.73	10.55	6.52	3.64	2.08	0.55	0.75	0.00	0.00	0.00	0.05
1891	13.21	0.00	0.05	2.40	0.55	5.27	2.46	1.79	0.26	0.05	0.00	0.00	0.37
1892	16.14	0.08	0.46	5.84	1.11	1.60	4.75	0.65	1.60	0.05	0.00	0.00	0.00
1893	25.17	1.00	4.00	7.77	2.95	2.68	5.12	1.35	0.30	0.00	0.00	0.00	0.00
1894	14.00	0.00	0.81	1.69	4.73	2.61	0.69	0.63	1.36	0.40	0.00	0.00	1.08
1895	22.29	1.32	0.55	7.80	6.28	1.42	1.46	2.05	1.36	0.00	0.00	0.00	0.05
1896	14.71	0.83	1.08	0.84	5.17	0.27	2.22	2.79	0.44	0.00	0.01	0.74	0.32
1897	15.70	1.30	2.82	2.55	1.68	3.43	2.64	0.91	0.16	0.00	0.00	0.00	0.21
1898	7.79	1.01	0.37	1.20	0.93	1.93	0.52	0.20	0.44	0.06	0.00	0.00	1.13
1899	8.79	0.61	0.45	0.44	1.78	0.21	4.17	0.48	0.65	0.00	0.00	0.00	0.00
1900	14.06	3.26	2.70	1.43	2.05	0.44	1.36	1.66	0.96	0.01	0.02	0.00	0.17
1901	20.13	0.62	4.36	1.32	3.98	5.47	0.75	2.37	0.82	0.00	0.00	0.00	0.44
1902	12.54	1.00	1.06	0.43	0.81	4.42	2.65	1.29	0.88	0.00	0.00	0.00	0.00
1903	13.89	0.95	2.18	0.92	2.74	1.27	4.99	0.84	0.00	0.00	0.00	0.00	0.00
1904	12.66	0.12	0.99	0.34	1.28	3.01	2.73	1.74	0.26	0.00	0.00	0.25	1.94
1905	15.77	1.43	1.20	2.28	2.70	2.65	2.73	1.01	1.77	0.00	0.00	0.00	0.00
1906	15.22	0.00	2.17	1.23	2.86	2.31	4.44	0.90	0.75	0.43	0.00	0.00	0.13
1907	22.65	0.01	0.98	6.39	4.61	1.88	7.75	0.46	0.08	0.42	0.00	0.00	0.06
1908	11.99	0.98	0.13	3.65	2.63	2.46	1.14	0.23	0.67	0.01	0.00	0.00	0.09
1909	18.97	0.19	1.11	1.54	7.69	4.87	2.77	0.00	0.00	0.05	0.00	0.00	0.75
1910	13.90	0.72	1.27	5.41	2.31	0.83	2.84	0.41	0.00	0.02	0.00	0.00	0.09
1911	22.56	0.20	0.28	0.68	12.38	2.03	6.26	0.45	0.21	0.07	0.00	0.00	0.00
1912	11.30	0.81	0.18	2.03	1.36	0.30	2.80	1.95	0.70	0.46	0.00	0.00	0.71

Monthly Total Rainfall at San Jose

DWR # E60 7821 00

Latitude 37.342°

Data From : Climatological Data, City of Jan Jose

Longitude -121.903°

Elevation 95 Feet

Year	Sum	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1913	5.81	0.21	0.29	0.43	2.29	0.09	1.17	0.38	0.77	0.01	0.09	0.08	0.00
1914	19.28	0.02	4.10	3.00	6.23	3.94	0.90	0.65	0.19	0.25	0.00	0.00	0.00
1915	22.74	0.50	1.36	3.73	4.85	7.02	1.49	1.07	2.69	0.00	0.00	0.04	0.00
1916	17.06	0.00	0.19	4.37	8.71	1.83	1.10	0.06	0.01	0.00	0.00	0.01	0.78
1917	11.85	0.84	0.41	3.48	0.98	4.88	0.77	0.26	0.22	0.00	0.00	0.00	0.01
1918	15.68	0.00	0.54	0.55	0.70	2.63	4.48	0.45	0.00	0.00	0.00	0.00	6.33
1919	12.80	0.15	2.24	1.28	1.06	4.87	2.87	0.06	0.01	0.00	0.00	0.01	0.25
1920	8.57	0.28	0.09	2.48	0.10	1.04	3.43	0.92	0.00	0.21	0.00	0.00	0.02
1921	15.20	1.71	1.84	3.58	4.75	1.10	0.80	0.40	0.82	0.00	0.00	0.00	0.21
1922	14.56	0.21	1.65	4.66	2.46	3.01	1.74	0.32	0.50	0.01	0.00	0.00	0.00
1923	14.48	1.55	2.72	4.68	1.93	1.02	0.31	1.52	0.02	0.10	0.00	0.01	0.62
1924	5.92	0.29	0.30	0.71	1.70	0.62	1.87	0.38	0.05	0.00	0.00	0.00	0.00
1925	14.28	1.72	1.25	1.92	0.86	3.09	1.88	1.55	1.96	0.01	0.02	0.00	0.01
1926	14.44	0.48	0.96	1.33	3.11	5.35	0.12	2.88	0.21	0.00	0.00	0.00	0.00
1927	13.90	0.31	3.44	1.17	2.07	4.01	1.58	1.03	0.08	0.19	0.00	0.00	0.02
1928	10.09	0.83	1.25	2.01	0.98	1.78	2.12	0.96	0.15	0.01	0.00	0.00	0.00
1929	10.14	0.01	2.47	2.40	0.86	0.61	1.31	0.92	0.11	1.45	0.00	0.00	0.00
1930	10.89	0.00	0.00	0.78	3.49	1.86	2.93	0.76	1.01	0.00	0.00	0.01	0.05
1931	8.30	0.23	0.73	0.49	3.56	1.20	0.54	0.40	1.08	0.07	0.00	0.00	0.00
1932	13.40	0.10	1.79	5.57	2.28	2.53	0.45	0.20	0.48	0.00	0.00	0.00	0.00
1933	8.90	0.00	0.36	2.02	4.12	0.40	1.47	0.15	0.37	0.00	0.00	0.00	0.01
1934	8.96	0.78	0.00	3.05	0.41	2.60	0.00	0.34	1.23	0.33	0.00	0.00	0.23
1935	16.49	0.52	2.19	2.78	3.65	0.81	2.62	3.38	0.00	0.00	0.00	0.54	0.00
1936	11.90	0.99	0.11	1.05	1.50	5.74	0.73	0.88	0.75	0.12	0.03	0.00	0.00
1937	16.90	0.83	0.01	3.08	2.69	3.45	5.97	0.74	0.03	0.10	0.00	0.00	0.00
1938	18.57	0.62	1.27	2.57	4.13	5.46	3.40	1.12	0.00	0.00	0.00	0.00	0.00
1939	10.76	1.12	1.21	1.31	2.47	1.49	2.15	0.45	0.29	0.00	0.00	0.00	0.28
1940	16.35	0.88	0.17	0.55	4.81	6.15	3.04	0.47	0.10	0.00	0.00	0.00	0.18
1941	21.26	0.31	0.59	5.01	3.54	5.05	3.16	3.20	0.36	0.02	0.00	0.01	0.00
1942	16.56	0.64	0.37	4.93	3.95	1.48	1.84	2.79	0.48	0.01	0.00	0.00	0.07
1943	13.13	1.01	1.19	1.23	4.02	1.82	2.71	1.13	0.00	0.02	0.00	0.00	0.00
1944	11.47	0.25	0.37	0.97	1.98	5.90	0.78	0.90	0.28	0.04	0.00	0.00	0.00
1945	12.44	1.77	2.76	2.05	0.37	2.39	2.49	0.22	0.28	0.10	0.00	0.01	0.00
1946	11.26	1.19	1.19	3.95	0.81	1.72	1.49	0.01	0.86	0.00	0.00	0.00	0.04
1947	9.00	0.02	1.76	2.30	0.62	1.57	1.76	0.51	0.22	0.24	0.00	0.00	0.00
1948	9.89	1.29	0.81	0.72	0.16	1.15	1.97	3.19	0.56	0.04	0.00	0.00	0.00
1949	11.59	0.38	0.09	3.56	0.58	1.83	4.61	0.00	0.43	0.00	0.01	0.10	0.00
1950	8.31	0.25	0.94	1.08	3.20	0.84	0.98	0.75	0.16	0.00	0.00	0.00	0.11
1951	14.13	1.61	3.20	3.85	1.87	1.80	0.50	0.53	0.53	0.01	0.00	0.00	0.22

E60 M San Jose

Monthly Total Rainfall at San Jose

DWR # E60 7821 00

Data From : Climatological Data, City of San Jose

Latitude 37.342°

Longitude -121.903°

Elevation 95 Feet

Year	Sum	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1952	19.57	0.55	2.14	4.06	6.34	0.92	4.16	1.26	0.08	0.02	0.04	0.00	0.00
1953	9.68	0.01	1.42	4.56	1.40	0.02	0.96	0.75	0.38	0.08	0.00	0.09	0.00
1954	9.98	0.20	1.74	0.50	2.21	1.72	2.99	0.39	0.12	0.12	0.00	0.00	0.00
1955	11.85	0.00	1.32	2.96	4.13	1.53	0.05	1.12	0.74	0.00	0.00	0.00	0.00
1956	18.54	0.01	1.06	9.26	4.66	0.87	0.07	1.01	1.15	0.00	0.00	0.00	0.45
1957	9.86	0.52	0.00	0.47	2.79	2.72	0.82	0.94	1.21	0.12	0.00	0.00	0.27
1958	21.72	0.92	0.22	2.75	2.91	5.39	4.83	3.68	0.53	0.41	0.00	0.03	0.04
1959	11.74	0.01	0.23	0.60	3.05	4.95	0.25	0.60	0.01	0.00	0.00	0.00	2.04
1960	8.39	0.00	0.00	0.63	2.91	3.27	0.48	0.80	0.28	0.00	0.02	0.00	0.00
1961	10.05	0.05	2.87	1.29	1.36	0.80	2.03	0.76	0.59	0.12	0.00	0.04	0.14
1962	12.44	0.06	2.63	1.28	0.81	5.61	1.95	0.10	0.00	0.00	0.00	0.00	0.00
1963	20.50	4.59	0.28	2.00	4.00	2.23	3.53	3.08	0.52	0.02	0.00	0.00	0.25
1964	10.30	1.17	3.01	0.12	3.38	0.23	1.14	0.21	0.38	0.56	0.00	0.10	0.00
1965	15.09	0.96	2.69	5.00	2.13	0.48	1.74	1.93	0.00	0.00	0.00	0.16	0.00
1966	10.81	0.25	3.98	3.20	1.19	0.98	0.36	0.37	0.06	0.02	0.21	0.00	0.19
1967	19.63	0.00	3.05	2.17	4.87	0.14	5.14	3.89	0.03	0.31	0.00	0.00	0.02
1968	15.08	0.19	1.27	2.15	5.37	0.77	2.62	0.57	0.18	0.00	0.00	1.96	0.00
1969	19.30	0.30	2.02	1.85	5.56	6.63	1.07	1.70	0.03	0.00	0.00	0.00	0.14
1970	11.17	0.62	0.93	1.57	4.02	1.45	2.26	0.21	0.02	0.10	0.00	0.00	0.00
1971	14.92	0.35	6.18	3.93	0.91	0.54	1.56	1.24	0.08	0.00	0.00	0.01	0.12
1972	6.85	0.00	0.70	3.29	1.21	0.33	0.07	0.51	0.00	0.14	0.00	0.00	0.60
1973	22.79	2.19	5.48	1.18	5.12	5.97	2.75	0.05	0.01	0.00	0.00	0.00	0.04
1974	16.30	2.22	2.79	2.67	2.51	0.82	3.30	1.73	0.00	0.08	0.18	0.00	0.00
1975	14.16	1.11	0.39	2.02	0.84	3.08	4.51	1.32	0.01	0.04	0.15	0.68	0.01
1976	6.67	1.30	0.15	0.26	0.32	1.26	0.95	0.62	0.00	0.07	0.00	0.71	1.03
1977	7.90	0.54	0.93	0.80	0.76	0.55	1.92	0.03	1.70	0.01	0.08	0.00	0.58
1978	21.22	0.21	0.78	2.34	7.07	2.95	4.55	3.30	0.00	0.00	0.00	0.00	0.02
1979	12.24	0.00	1.49	0.42	3.67	3.21	2.23	1.06	0.10	0.00	0.07	0.00	0.00
1980	19.47	1.63	1.29	3.30	2.62	5.80	2.06	1.89	0.13	0.00	0.75	0.00	0.00
1981	10.28	0.07	0.15	1.44	3.71	1.30	3.13	0.26	0.20	0.00	0.00	0.00	0.02
1982	16.26	1.70	3.77	1.54	4.46	1.69	0.00	1.90	0.00	0.15	0.00	0.01	1.04
1983	29.71	1.49	3.53	1.99	7.41	4.33	6.40	3.90	0.15	0.00	0.00	0.02	0.49
1984	12.95	0.78	5.26	3.83	0.17	1.44	0.88	0.56	0.00	0.01	0.00	0.00	0.02
1985	13.09	1.75	3.94	1.73	0.74	0.76	2.98	0.48	0.23	0.00	0.13	0.00	0.35
1986	19.14	0.98	2.47	1.40	2.41	6.05	3.99	0.66	0.16	0.00	0.00	0.00	1.02
1987	6.78	0.08	0.17	0.85	1.60	2.10	1.84	0.14	0.00	0.00	0.00	0.00	0.00
1988	11.14	0.93	1.65	3.31	2.08	0.62	0.06	1.82	0.66	0.01	0.00	0.00	0.00
1989	9.15	0.06	1.42	2.14	1.06	1.07	1.91	0.57	0.09	0.00	0.00	0.00	0.83
1990	9.59	1.33	0.80	0.04	1.93	1.61	0.89	0.22	2.38	0.00	0.15	0.00	0.24

Monthly Total Rainfall at San Jose

DWR # E60 7821 00

Data From : Climatological Data, City of San Jose

Latitude 37.342°

Longitude -121.903°

Elevation 95 Feet

Year	Sum	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1991	11.64	0.25	0.24	2.03	0.18	2.22	6.17	0.18	0.15	0.06	0.00	0.04	0.12
1992	16.07	0.85	0.43	2.43	1.73	6.59	3.37	0.42	0.00	0.25	0.00	0.00	0.00
1993	21.27	0.66	0.05	4.51	6.98	4.71	2.81	0.54	0.47	0.54	0.00	0.00	0.00
1994	12.39	0.67	2.17	1.99	1.33	3.03	0.44	1.47	1.21	0.01	0.00	0.00	0.07
1995	23.62	0.27	2.37	1.76	8.66	0.53	6.85	1.06	1.27	0.84	0.01	0.00	0.00
1996	17.44	0.00	0.05	4.71	3.03	4.84	2.63	0.75	1.42	0.00	0.00	0.00	0.01
1997	15.85	1.08	1.65	4.63	6.80	0.14	0.17	0.11	0.55	0.21	0.00	0.51	0.00
1998	28.43	0.69	5.01	1.85	4.81	10.23	2.40	1.46	1.93	0.00	0.00	0.00	0.05
1999	13.77	0.60	1.77	0.72	3.25	2.88	2.69	1.56	0.02	0.14	0.14	0.00	0.00
2000													
2001													
Average	14.13	0.70	1.47	2.44	2.83	2.42	2.29	1.12	0.44	0.10	0.02	0.05	0.23
Max	30.35	4.59	7.39	10.55	12.38	7.02	7.75	4.47	2.69	2.15	0.75	1.96	6.33
Min	4.72	0.00	0.00	0.00	0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00

by-pass line
Worksheet for Pressure Pipe

Project Description	
Project File	c:\mikes engineering stuff\engineering\flowmast\haestad\fmw\site 27-.fm2
Worksheet	dry season by-pass line @ 5.5 cfs
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	50.00 feet H2O PUMP HEAD REQUIRED
Pressure at 2	0.00 psi OPEN FLOW DISCHARGE
Elevation at 1	1.00 ft HEAD WATER
Elevation at 2	0.00 ft
Length	1,200.00 ft CONSTRUCTION ZONE BYPASS LENGTH
C Coefficient	140.0 STEEL PIPE
Diameter	8.00 in

Results	
Discharge	3.7847 cfs DESIGN FOR 3 CFS
Headloss	51.00 ft
Energy Grade at 1	53.21 ft
Energy Grade at 2	2.22 ft
Hydraulic Grade at 1	51.00 ft
Hydraulic Grade at 2	0.00 ft
Flow Area	0.35 ft ²
Wetted Perimeter	2.39 ft
Velocity	10.84 ft/s ≈ 10 FT/SEC ✓ (LESS THAN 10 FT/SEC BETTER)
Velocity Head	1.83 ft TRY VARIABLE SPEED
Friction Slope	0.042493 ft/ft PUMP - HEAD

by-pass line
Worksheet for Pressure Pipe

Project Description	
Project File	c:\mikes engineering stuff\engineering\flowmast\haestad\fmw\site 27-.fm2
Worksheet	dry season by-pass line @ 5.5 cfs
Flow Element	Pressure Pipe
Method	Hazen-Williams Formula
Solve For	Discharge

Input Data	
Pressure at 1	19.98 feet H2O
Pressure at 2	0.00 psi
Elevation at 1	1.00 ft
Elevation at 2	0.00 ft
Length	1,200.00 ft
C Coefficient	110.0
Diameter	8.00 in

VARIABLE SPEED PUMP

Results		
Discharge	1.8405	cfs
Headloss	20.97	ft
Energy Grade at 1	21.30	ft
Energy Grade at 2	0.32	ft
Hydraulic Grade at 1	20.97	ft
Hydraulic Grade at 2	0.00	ft
Flow Area	0.35	ft ²
Wetted Perimeter	2.09	ft
Velocity	5.27	ft/s
Velocity Head	0.43	ft
Friction Slope	0.017479	ft/ft

~ 2 cfs

✓ OK



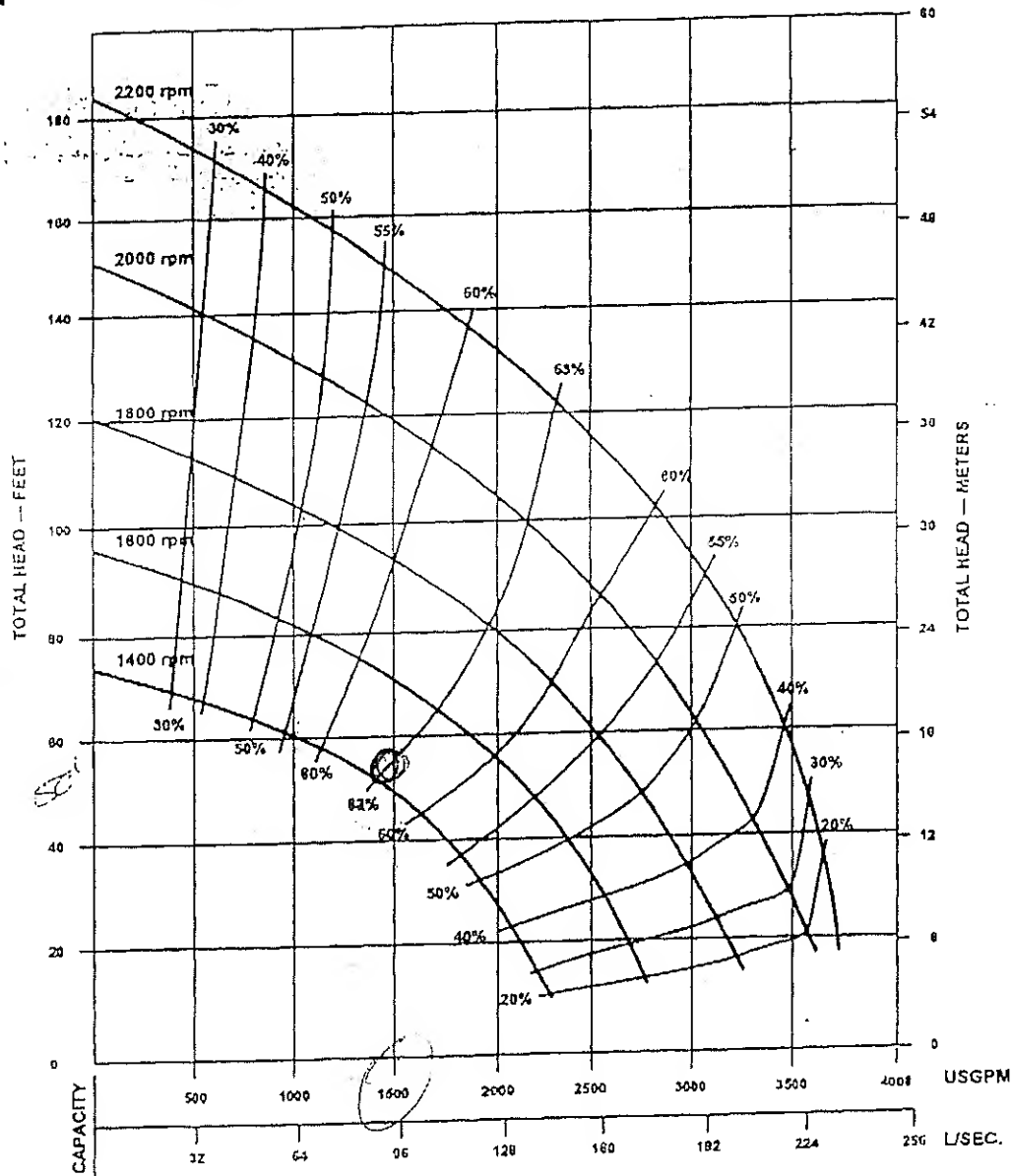
ENGINEERING CATALOG

CD225M Dri-Prime® Pump Engineering Data

Pump
Curve
Branch Sizes
Speed

CD225M
CD20M-4V
8" x 8" (200mm x 200mm)
Variable

DRY SEASON-BASED FLOW
BY PASS PUMP - 3 CFS
8" DISCHARGE





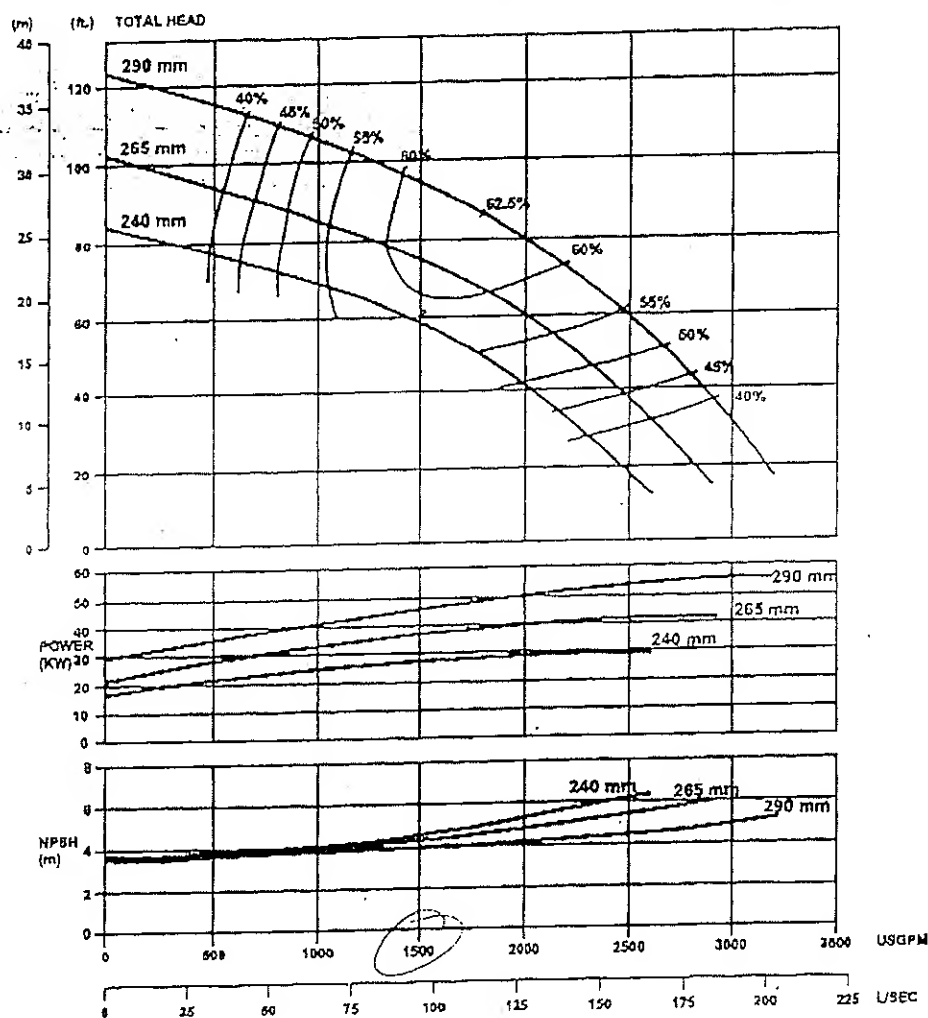
ENGINEERING CATALOG

CD225M Dri-Prime® Pump Engineering Data

Pump
Curve
Branch Sizes
Speed

CD225M Electric
CD225M-ELEC.3
8" x 8" (200mm x 200mm)
1800 rpm

DRY SEASON BASE FLOW
BY PASS PUMP - 3CFS
8" DISCHARGE



Notes:

1. Max. impeller diameter: 290 mm.
2. Min. impeller diameter: 240 mm.
3. Max. solids handling: 75mm., dia.
4. Add 12% for V-Belt drives.
5. Max. V-Belt speed: 1800 rpm.
6. Where a compressor is fitted, add 2.6 kw for small size and add 8.25 kw for large size.



ENGINEERING CATALOG

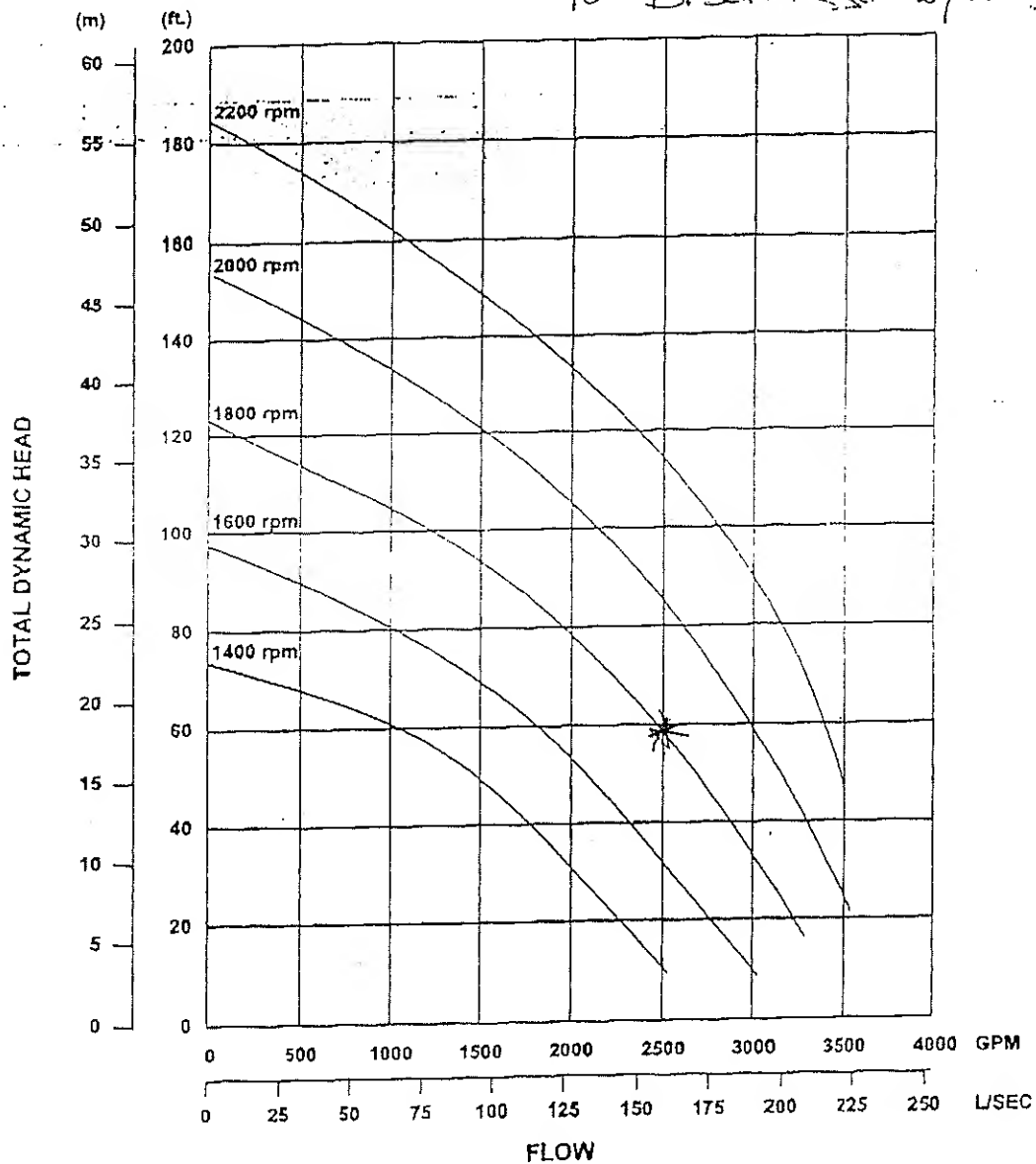
CD250M Dri-Prime® Pump Engineering Data

Pump
Curve
Branch Sizes
Speed

CD250M
CD250M DIESEL
10" x 10" (250mm x 250mm)
Variable

STORM EVENT BACKUP

10" DISCHARGE w/ LARGE PUMP



H.2 PUMP SIZING, VOLUME OF DITCH, VOLUME OF RETENTION BASIN, AND BERM HEIGHT

CALCULATION COVER SHEET

Sheet 1 of: 5

Project: Moffet IR27 Remedial Design		Subject: Pump sizing, volume of ditch, volume of retention basin, and berm height.	
Client: DON			
Calculation No.:		Project No.: 3048	
No. of Sheets:		Design Level:	
Calculation By Others: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>		Preparer: Michael Toy	
Reviewed By: Mauricio Paz			Date: 7/11/05
Assumptions That Require Confirmation: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>			
Assumptions Confirmed By: Mauricio Paz			Date: 7/8/05

Print Name, Date, and Initial:

Rev No	Affected Sheets	Prepared by	Date	Checked by	Date
1	1	Michael Toy <i>MT</i>	7/7/05	Mauricio Paz <i>MP</i>	7/11/05

Pipe Loss Calculations for dewatering pump

Flow Characteristics	Equation for Reynolds No.
250 Q, flow in gallons per minute 6 D, pipe diameter in inches 2.84 V, velocity in feet/sec 9.62E-06 nu, kinematic viscosity @ 75 degrees F 147443 Rd (Reynolds Number)	$R_D = \frac{D V}{\nu}$

therefore, turbulent flow conditions:

Apply Colebrook equation for friction factor:

Equation for friction factor
<div> <div>0.000023 ε, epsilon</div> <div>0.016844 friction factor, modified Colebrook equation</div> <div> 0.000001 e, epsilon for PVC (in feet) 0.000023 e, epsilon for HDPE (in feet) 1.50E-04 e, epsilon for steel (in feet) </div> </div> $f = \frac{0.25}{\left[\log_{10} \left(\frac{\varepsilon}{3.7 D} + \frac{5.74}{R_D^{0.9}} \right) \right]^2}$

300 L, pipe length in feet
32.17 g, gravitational constant (ft/sec²)

Major Loss (hl)	Equation for head loss
1.26 dynamic head loss in feet - "major loss" using Colebrook friction factor 0.55 dynamic head loss in PSI - "major loss" using Colebrook friction factor	$hl = k \frac{L}{D} \frac{V^2}{2g}$

Minor Loss
0.25 20% of major loss in feet - Colebrook 0.11 20% of major loss in PSI - Colebrook

elevation head
10 height of equalization tank in feet 6 depth of detention basin in feet 0 grade change in feet (estimated from survey data)
total head for pumping
17.5 in feet, Colebrook 7.6 in PSI, Colebrook

Calculation for Volume of North Patrol Road Ditch

Assumptions

- Length of ditch is 4,300 feet
- Representative cross-sectional area of ditch is the average cross sectional area of 3 cross sections for the ditch (Transect 2, 3, and 4) shown on Drawing C-18
- Using Autocad function, the following areas were calculated for each transect:
transect 2 = 305 square feet; transect 3 = 313 square feet; transect 4 = 255 square feet

Formula for Volume of Ditch

$$\begin{aligned}\text{Volume} &= \text{average cross sectional area} \times \text{length of ditch} \\ &= (305 \text{ sq ft} + 313 \text{ sq ft} + 255 \text{ sq ft})/3 \times 4,300 \text{ feet} \\ &= 1,251,300 \text{ cubic feet}\end{aligned}$$

Calculation for Volume of Marriage Road Ditch

Assumptions

- Length of ditch is 2,300 feet
- Representative cross-sectional area of ditch is the average cross sectional area of 3 cross sections for the ditch (cross sections A-A', B-B', and C-C') shown on Drawing C-15
- Using Autocad function, the following areas were calculated for each cross section:
cross section A-A' = 90 square feet; cross section B-B' = 39 square feet; cross section C-C' = 52 square feet

Formula for Volume of Ditch

$$\begin{aligned}\text{Volume} &= \text{average cross sectional area} \times \text{length of ditch} \\ &= (90 \text{ sq ft} + 39 \text{ sq ft} + 52 \text{ sq ft})/3 \times 2,300 \text{ feet} \\ &= 138,767 \text{ cubic feet}\end{aligned}$$

Total Capacity of Two Ditches = 1,400,000 cubic feet

Runoff for 2-year 24 hour storm event = $0.55 \times 2 \text{ inches} / 12 \times 1015 \text{ acres} \times 43560 \text{ sq ft/acre}$
= 4,050,000 cubic feet

Runoff for average September storm event all in 24 hours = 470,000 cubic feet

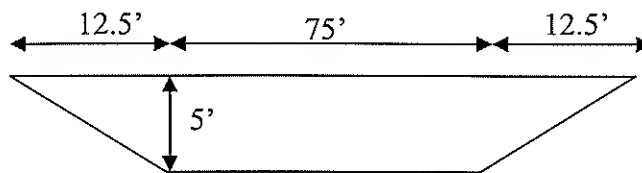
20,000

Calculation for Volume of Detention Basin

Assumptions

- 6 feet in depth
- 1 foot of freeboard
- detention basin is triangular in shape with height of 110 feet and base of 100 feet
- the embankment slope is 1:2.5

Cross-Section of detention basin at base



$$\text{Cross sectional area} = 12.5' \times 5' + 75' \times 5' = 437.5 \text{ sq feet}$$

Formula for Volume of Detention Basin

$$\text{Volume} = \frac{1}{2} \times \text{cross-sectional area of detention basin at base} \times \text{height}$$

$$\begin{aligned} &= \frac{1}{2} \times 437.5 \text{ sq feet} \times 110 \text{ feet} \\ &= 24,062 \text{ cubic feet} \\ &\sim 180,000 \text{ gallons} \end{aligned}$$

Calculation for Runoff Volume from 10-year 24 hour rain event for 4 Pads

Assumptions

- combined area of the 4 pads is 200 feet by 200 feet (40,000 square feet)
- The 10-year 24 hour rain event is 3 inches
- Assume C = 1 for conservativeness

Formula for Volume of Storm Runoff

$$\text{Volume} = \text{precipitation from 10-year 24 hour rain event} \times \text{area}$$

$$\begin{aligned} &= \frac{3''}{12} \times 40,000 \text{ square feet} \\ &= 10,000 \text{ cubic feet} \\ &= 74,800 \text{ gallons} \end{aligned}$$

Calculation for minimum height of temporary berm for Equipment Storage Area

Assumptions

- The total area of the Equipment Storage Area is the area of a triangle with height of 50 feet and base of 100 feet plus the area of a rectangle with width of 50 feet and length of 100 feet
- The volume to be contained is 21,000 gallons (one Baker tank) + 10-year 24-hour storm (3 inches/24 hours)
- Minimum freeboard is 5 inches

Formula for height of temporary berm

Height = Volume of 1 Baker tank/ area of Equipment Storage Area + precipitation from 24-hr storm event + minimum freeboard

$$\begin{aligned} &= 21,000 \text{ gal}/7.48 / (1/2 \times 50 \text{ feet} \times 100 \text{ feet} + 50 \text{ feet} \times 100 \text{ feet}) + 3 \text{ in}/12 + 5 \text{ in}/12 \\ &= 1.0 \text{ feet} \end{aligned}$$

H.3 SLOPE STABILITY ANALYSES



CALCULATION COVER SHEET

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PROJECT Site 27 - Moffett Field CLIENT NavySUBJECT Slope Stability AnalysesCALCULATION NO CALC-MAF-001 REVISION NO 0TOTAL NO OF PAGES 13Computer Program Used in Calculation: STABL for WindowsCalculation by Others: YES ☐ NO ☒Assumptions that Require Confirmation: YES ☐ NO ☒

Assumptions Confirmed By:	<u>N/A</u> Print Name	 Signature	 Date
Prepared By:	<u>Timothy Lai</u> Print Name	 Signature	 Date
Checked By:	<u>Faouzi Ahtchi-Ali</u> Print Name	 Signature	 Date
Verified By:	<u>NA</u> Print Name	 Signature	 Date

APPROVALS

LDE:	<u>N/A</u> Print Name	 Signature	 Date
Project Engineer:	<u>Mike Cowan</u> Print Name	 Signature	 Date



CALCULATION COVER SHEET (Continued)

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REVISION HISTORY

<i>Rev No.</i>	<i>Affected Pages</i>	<i>Description of Change</i>	<i>Technical Basis for Change</i>
0	All	Original Calculation	Original Calculation



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1.0 PURPOSE

This calculation documents the slope stability analyses performed for the Site 27 former Naval Air Station Moffett Field Project. The scope of this calculation includes performing stability analyses on a representative slope to investigate the impact of dredging sediments from the existing channel.

2.0 ACCEPTANCE CRITERIA

Guidelines for the stability analyses are provided in Title 27 California Code of Regulations (CCR). In stability analyses, a factor of safety (F.S.) is calculated. This factor is defined as the ratio of resisting (stabilizing) forces to the driving forces trying to displace the slope. A F.S. greater than 1 implies that the slope is theoretically stable. A FS less than 1 implies that the slope is not stable and slope movement is possible. Currently, there is no specific value for the static factor of safety provided in the regulations. The current state of practice in California is to require a minimum F.S. of 1.2 during construction activities and a long term static F.S. of 1.5.


3.0 RESULTS SUMMARY

A representative cross section (Section CS 9+25/Transect 2, Drawing C-18, Appendix I) at Site 27 was selected and used in the slope stability analyses. The impact of two different drainage conditions, presence of surcharge (heavy truck) loading, and water level effects were investigated.

During dredging operations, "undrained" conditions exist where surcharge loading may cause pore pressure buildup. A surcharge loading of 3326 pounds per square feet psf of ground pressure was considered in the analysis. The surcharge loading was set at a distance of 1 foot away from the top of the slope. For this condition, a F.S. of 1.8 was computed, which is greater than the F.S. = 1.2 that is considered satisfactory during construction activities.

For evaluating the long-term performance, "drained" conditions were simulated. The computed factors of safety for dredged conditions (using the slope geometry after the proposed dredging) and for benched backfilled condition (fill material placed as buttress) are summarized in the following table.

Drained Condition (C = 420 psf, phi = 20 deg.)	De-watered		Low-water Level	
	Surcharge	No Surcharge	Surcharge	No Surcharge
Dredged Condition	1.26	2.26	1.25	2.48

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Benched Backfilled Condition	1.4	2.38	1.38	2.59
------------------------------	-----	------	------	------

The results show that the F.S. for long-term performance is greater than 1 for all cases and greater than 2 when there are negligible surcharge loading. However, in order to achieve a F.S. = 1.5, any surcharge loading should be limited to a maximum ground pressure of 2000 psf.

Section 7.0 presents plots illustrating the geometry of the slope cross sections and the 10 most critical potential failure planes searched by the computer program (STABL for Windows) for each of the analyses runs presented in the above table and the discussion.

4.0 INPUTS

4.1 CODES, STANDARDS, AND REGULATIONS

- Title 27 CCR
- Standard practice in the State of California (with regard to static slope stability F.S.)

4.2 LITERATURE DATA


- N/A

4.3 DESIGN INPUTS

Analyses Soil Profile and Parameters

The soil profiles were constructed using data from a topographic survey (Appendix E) and soil borings performed (Appendix F). There are primarily two main soil groups that make up the existing slope and channel bottom. The existing channel bottom consists of sediments that will be dredged out. Beneath this layer, a high plasticity clay (CH) material forms the slope and the base of the channel. The water table was approximated to be less than 5 feet from the top of slope.

The soil parameters used in the stability analyses were determined through geotechnical laboratory testing from undisturbed samples collected during the soil drilling investigation (See Results of Geotechnical and Bench Scale Testing [Twining Laboratories, 2005]). Direct shear test were performed to determine the shear strength parameters (internal friction angle and cohesion) under drained condition and unconfined compression test was performed to determine the undrained cohesion. Average values of the moisture content and in-place dry densities were used to obtain a wet (saturated)

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unit weight of 123 pounds per cubic foot (pcf). Based on the geotechnical test results, a cohesion value of 420 psf and friction angle of 20 degrees were used in the analyses for drained conditions and an undrained cohesion value of 1,100 psf was used for undrained conditions.

A surcharge loading of 3326 psf (23.1 pounds per square inch [psi] ground pressure specified in truck literature) was applied to simulate a loaded articulated 6-wheel hauler (Volvo model A25D 6x6) weighing 50 tons. The ground loading also included a 6-inch gravel base. This gravel base was included in all the cases considered.

4.4 OTHER INPUTS

No other design inputs are used.

4.5 ASSUMPTIONS

The following assumptions were used in this calculation:

- Soil strength properties as enumerated in Section 4.3
- Surcharge truck loading of a 50-ton articulated hauler
- No seismic analyses were required (during construction phase)

5.0 METHODOLOGY

Conventional two-dimensional limit-equilibrium analyses were performed to investigate the stability of slopes at Site 27 after the proposed channel sediment dredging. The computer program, STABL for Windows (Geotechnical Software Solutions, 2003), was used to calculate the F.S. against potential failure. This factor is defined as the ratio of resisting (stabilizing) forces to the driving forces trying to displace the slope. Bishop's Simplified Method using circular slip surfaces was used.

6.0 REFERENCES

- Geotechnical Software Solutions. 2003. *STABL for Windows, Version 2.2*.
- Twining Laboratories. 2005. Draft Results of Geotechnical and Bench Scale Testing - Moffett Air Field Project. June 20.



PROJECT: SITE 27

CALC. NO: CALC-MAF-001

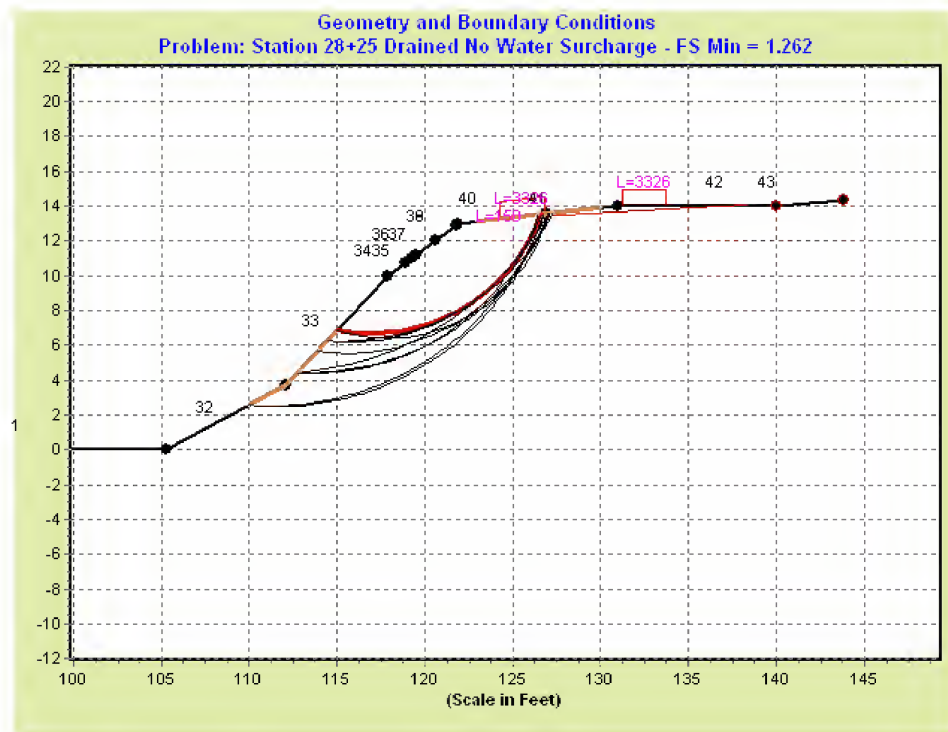
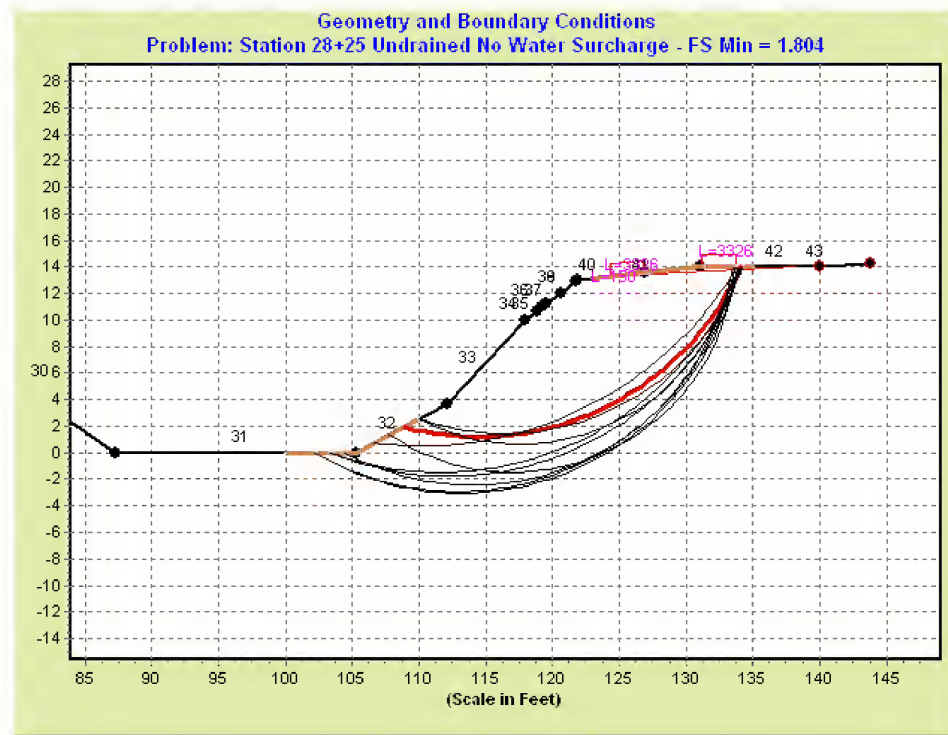
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DATE: 6/29/05

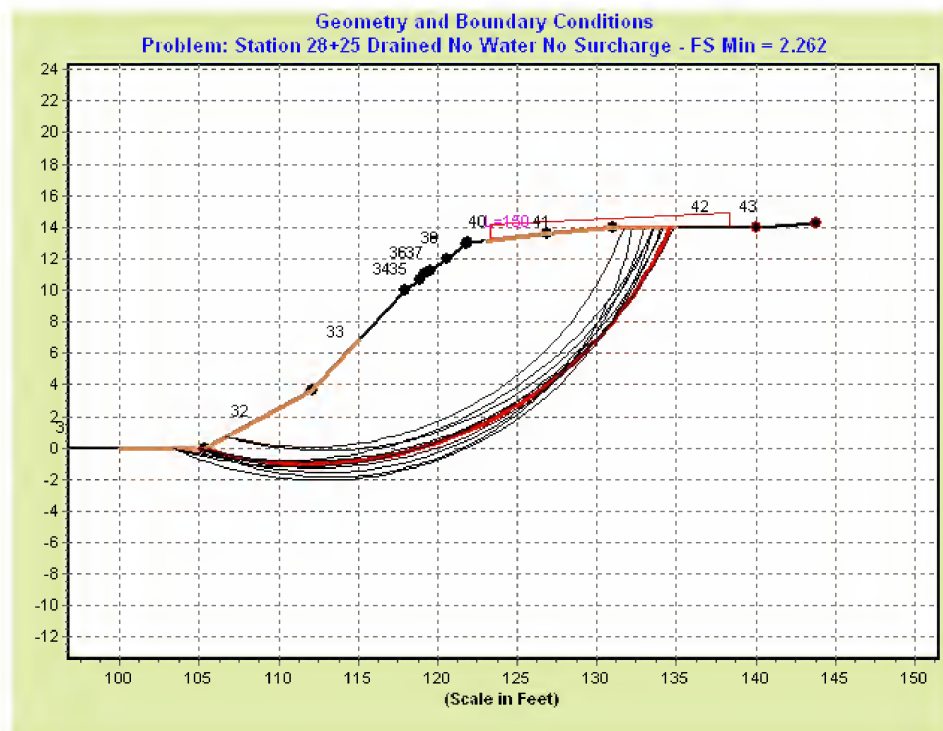
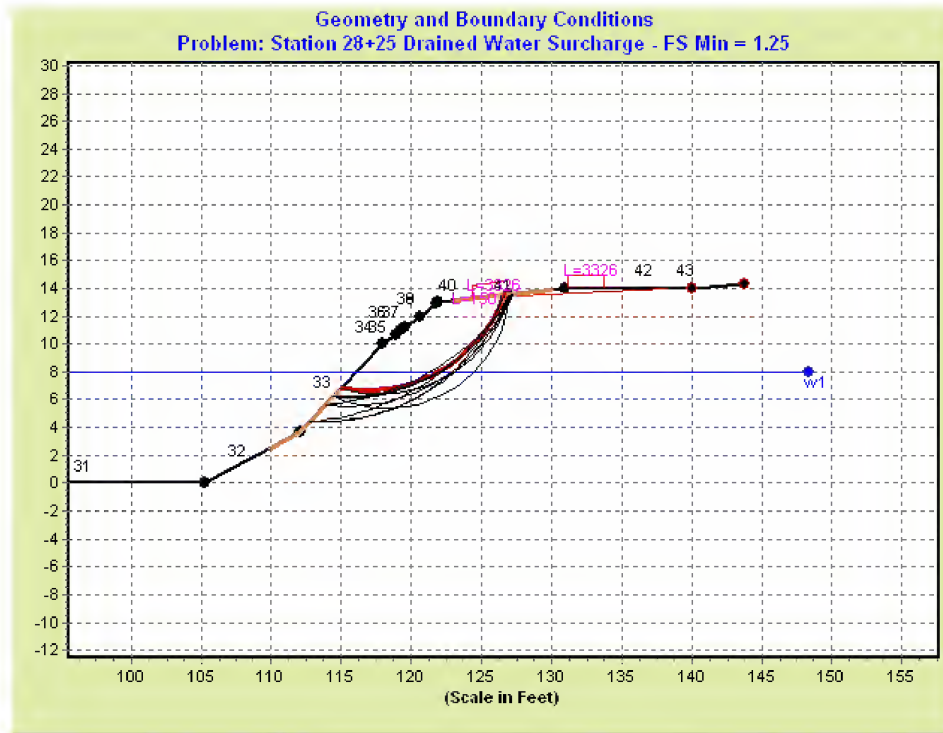
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SUBJECT: Slope Stability Analyses (Moffett Field)

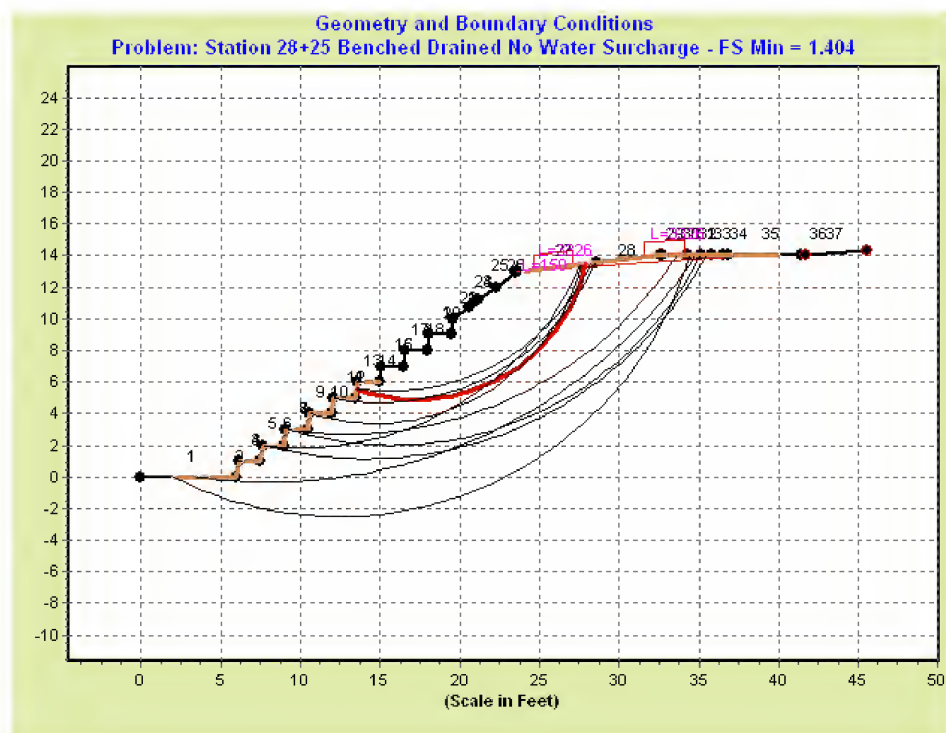
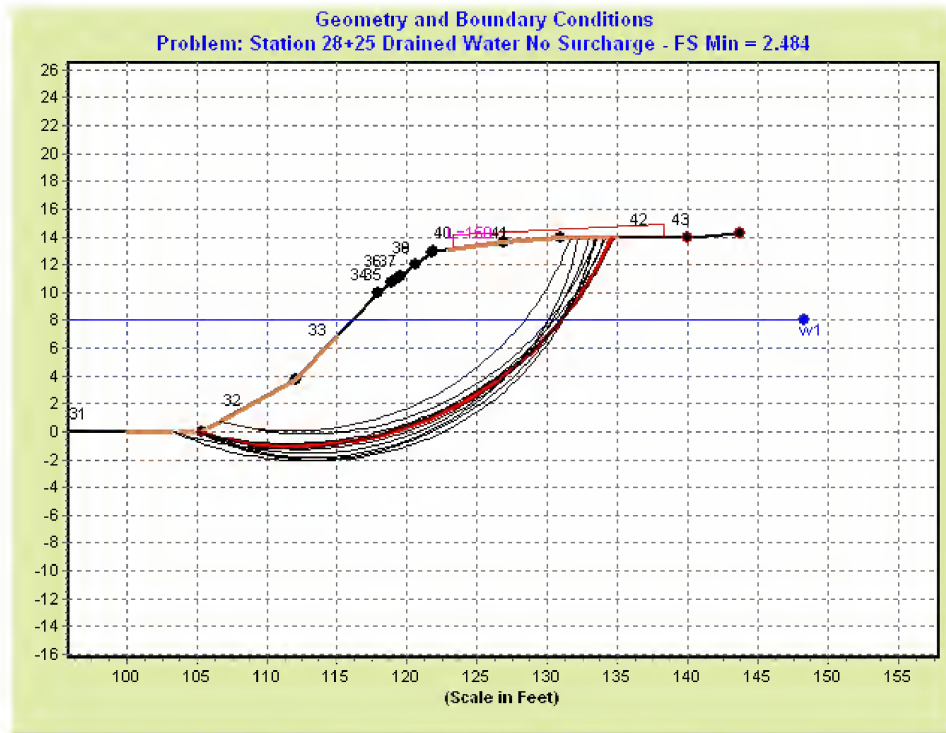
7.0 CALCULATION DETAILS (FIGURES/INPUT FILES)



H.4 EVALUATION OF LOCAL ROADS FOR CONSTRUCTION TRAFFIC



SUBJ ECT: Slope Stability Analyses (Moffett Field)





PROJECT: SITE 27

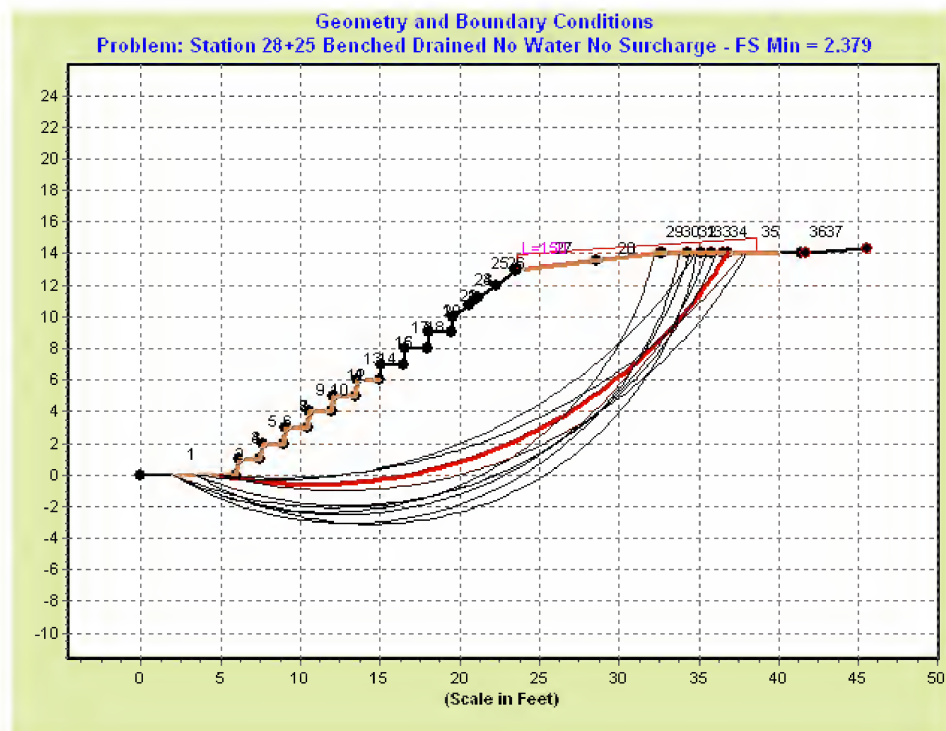
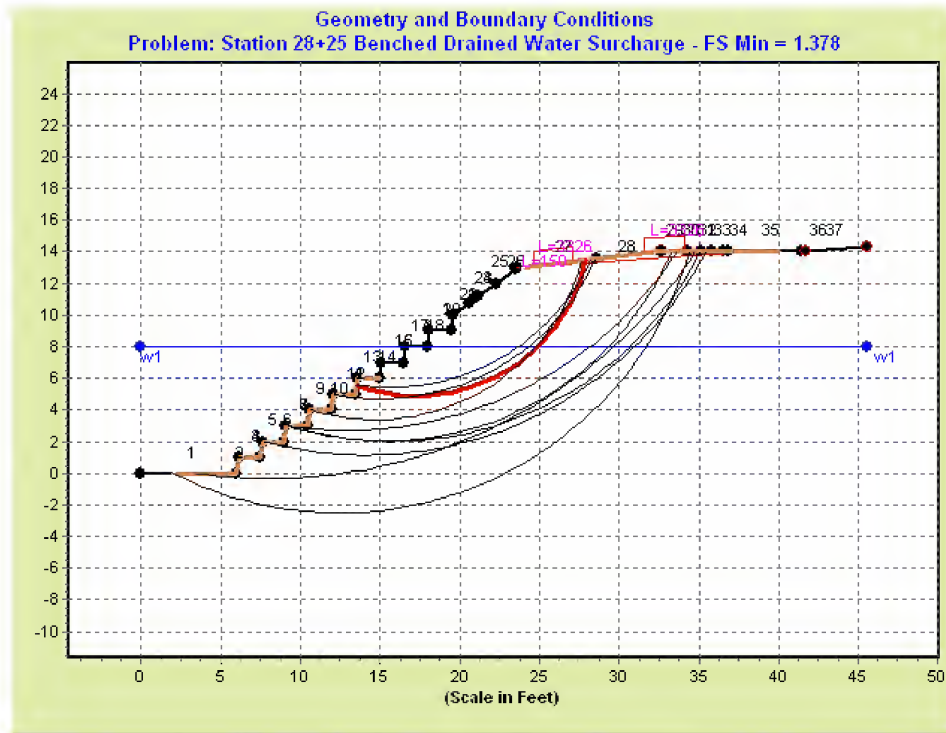
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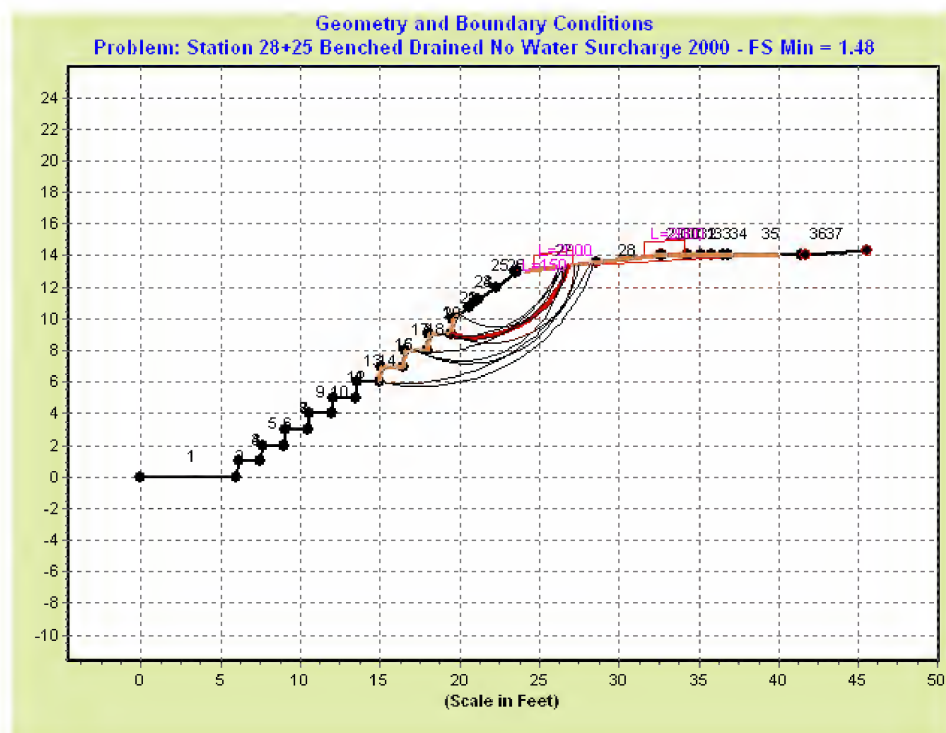
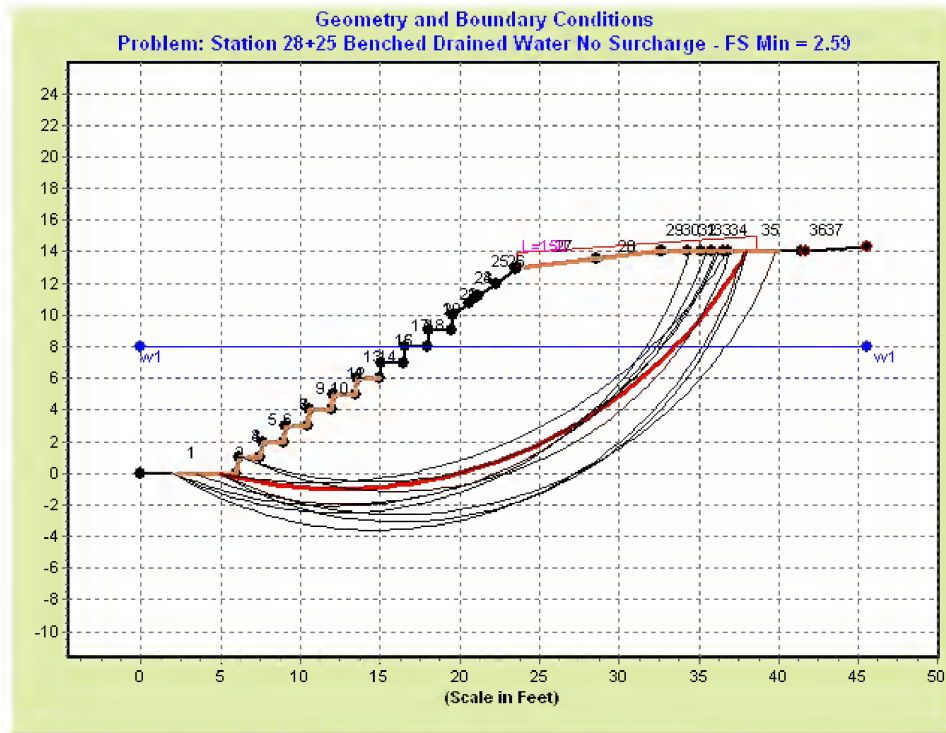
REV. 0


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SUBJECT: Slope Stability Analyses (Moffett Field)





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INPUT FILE FOR STABL FOR WINDOWS (for first case analyzed)

FIXEDSEED

PROFIL


Station 28+25 Undrained No Water Surcharge

```

43      43
0      12.9      2.400009      12.9      1
2.400009      12.9      12.60001      13      1
12.60001      13      19      13      1
19      13      20.3      13      1
20.3      13      24.10001      13      1
24.10001      13      26.8      13      1
26.8      13      29.9      12      1
29.9      12      31.4      10.9      1
31.4      10.9      32.7      10      1
32.7      10      37      6      1
37      6      38.9      6      1
38.9      6      41.5      6      1
41.5      6      43.8      7.1      1
43.8      7.1      47.10001      10      1
47.10001      10      47.7      10.3      1
47.7      10.3      48.8      11      1
48.8      11      50.2      11.9      1
50.2      11.9      50.4      12      1
50.4      12      52.8      12.2      1
52.8      12.2      59      12.6      1
59      12.6      64.60001      13      1
64.60001      13      66.4      13      1
66.4      13      67.2      13      1
67.2      13      67.7      12.8      1
67.7      12.8      69.2      12      1
69.2      12      70.5      11.3      1
70.5      11.3      71.10001      11      1
71.10001      11      71.60001      10.7      1
71.60001      10.7      73      10      1
73      10      87.3      0      1
87.3      0      105.3      0      1
105.3      0      112.1      3.7      1
112.1      3.7      117.9      10      1
117.9      10      118.9      10.7      1
118.9      10.7      119.2      11      1
119.2      11      119.5      11.2      1
119.5      11.2      120.6      12      1
120.6      12      121.8      12.9      1
121.8      12.9      121.9      13      1
121.9      13      126.9      13.6      1
126.9      13.6      131      14      1
131      14      140      14      1
140      14      143.8      14.3      1

```

SOIL

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	SUBJECT: Slope Stability Analyses (Moffett Field)				

1
 123 123 1100 0 0 0 1
 WATER
 1 62.4
 2
 0 8
 148.3 8
 LOADS
 3
 124.3 126.8 3326 0
 131.2 133.7 3326 0
 123.3 138.3 150 0
 CIRCL2
 10 20
 100 110 123 135
 -20 0.5 0 0



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PROJECT Site 27 - Moffett Field CLIENT NavySUBJECT Evaluation of Local Roads for Construction TrafficCALCULATION NO CALC-MAF-002 REVISION NO 0TOTAL NO OF PAGES 9Computer Program Used in Calculation: NoneComputer Program Verification/Validation Date: NoneComputer Identification Number: NoneCalculation by Others: YES ☐ NO ☒Assumptions that Require Confirmation: YES ☐ NO ☒

Assumptions Confirmed By:	<u>N/A</u>		
	Print Name	Signature	Date

Prepared By:	<u>Mike Shannon</u>		
	Print Name	Signature	Date

Checked By:	<u>Timothy Lai</u>		
	Print Name	Signature	Date

Verified By:	<u>N/A</u>		
	Print Name	Signature	Date

APPROVALS

LDE:	<u>N/A</u>		
	Print Name	Signature	Date

Project Engineer:	<u>Mike Cowan</u>		
	Print Name	Signature	Date



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[illegible]



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	SUBJECT: Evaluation of Local Roads for Construction Traffic				

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	SUBJECT: Evaluation of Local Roads for Construction Traffic				

1.0 PURPOSE

This calculation presents an evaluation of existing roads at former Naval Air Station Moffett Air Field for the impact of additional loads (end dump truck traffic) during remediation activities at the base.

2.0 ACCEPTANCE CRITERIA

The evaluation is based on design principles associated with the California Department of Transportation (Caltrans) method to design flexible pavements.

3.0 RESULTS SUMMARY

Macon road is expected to have negligible damage due to the addition of end-dump truck loads during the construction activities.

Marriage Road and E. Patrol Road are expected to be significantly damaged due to the increased demand from construction activities. These roads are not designed for semi tractor trailer truck traffic. Once significant damage occurs in the asphalt surface, the base could also be damaged, which will require re-grading and compacting.


4.0 INPUTS

4.1 LITERATURE DATA

- Caltrans Highway Design Manual (Highway Manual) – Chapter 600 – Pavement Structural Section, 2004.
- Civil Engineering Reference Manual (CE Manual) – Fourth edition.
- American Association of State Highway and Transportation (AASHTO) Guide for the Design of Pavement Structures, 1993.

4.2 DESIGN INPUTS

- Marriage Road – 2" asphalt pavement, 12" aggregate base
- E. Patrol Road – 2" asphalt pavement, 12" aggregate base
- Macon Road – 6" asphalt pavement, 12" aggregate base
- Estimated truck traffic due to construction – 70 trips/day, 5 days/week, 6 months

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5.0 ASSUMPTIONS

General assumptions:

- The existing condition of the roadway sections cannot be determined precisely without further extensive field and laboratory testing.
- The design life of the pavement is assumed to be 20 years. However, the amount of ongoing deterioration (stage of the design life) is unknown.
- The end-dump truck traffic is in addition to the original design traffic.
- The base/sub-base layer is assumed to have an R value of about 78. This is a commonly used value for untreated aggregate base courses.
- The basement soil (sub-grade) is assumed to have an R value of 15.

6.0 METHODOLOGY

The following methodology is used to evaluate the roadway.

- Using the existing cross section, determine the Traffic Index (TI).
- Use the TI to compute the design equivalent single axle load (ESAL) for the roadway.
- Add the increased loads due to the construction traffic to check if the section is adequate.
- Make a qualitative assessment of "damage".

7.0 CALCULATION DETAILS

From Table 16.20 of the Civil Engineering Reference Manual, the Class II and Class III and Class IV roads have the following values for ESAL:

Class II – 10,000

Class III – 100,000


Class IV – 1,000,000

From Table 602.4A of the Highway Design Manual, the TI values for the ESAL values are as follows:

ESAL = 10,000 TI = 5.0

ESAL = 100,000 TI = 7.0

ESAL = 1,000,000 TI = 9.0

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Check Macon Road Section

Compute the TI for the road section using the existing cross section. Compute the total gravel equivalent thickness for the asphalt and base layers. This is computed using the assumed R value for the subgrade material (R=15). Using equation 16.37 of CE Manual gives:

$$GE = 0.0032(TI)(100-R)$$

Assume an equivalent gravel factor (Gf) of the asphalt of 2.01 from Table 16.18 of CE Manual.

The aggregate base has a Gf of 1.10 from Table 16.18.

$$GE_{provided} = (6" \text{ asphalt})(2.01)/12 + (12" \text{ base})(1.10)/12 = 2.11 \text{ ft}$$

This gives a TI for the section of:

$$TI = GE / [(0.0032)(100-R)]$$

$$TI = 2.11 / [(0.0032)(100-15)] = 7.76 \quad (\text{use } 8.0 \text{ for design})$$

Check the asphalt pavement layer by using the R value of the base of 78.

$$GE_{required} = 0.0032(8.0)(100-78) = 0.56 \text{ ft}$$

Thickness of asphalt required:

$$THK_{asphalt} = 0.56 / 2.01 = .28 \text{ ft} = 3.34 \text{ in}$$

From Table 602.4A of the Highway Manual, a TI of 8 corresponds to an ESAL value between 288,000 and 487,000 (use 400,000).

Find the average daily semi-truck traffic for this ESAL level. Use the 20 year design constant for the 5-axle truck of 13780 (Table 602.3A).

$$\text{Average} = 400,000 / 13780 = 29 \text{ trucks/day}$$

Find the ESAL for the end-dump truck construction traffic. Assume that the end dump trucks are 5-axle tractor trailers loaded to the state weight limit of 80 kips. The following distribution of axle loading is assumed:



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Tractor single axle: 8 kips
 Tractor tandem axle: 36 kips
 Trailer tandem axle: 36 kips

(note that these are greater than the HS20 truck loads of 8 kips, 32 kips and 32 kips)

Each axle has a load equivalency factor to convert it to an ESAL value. The following tables from the AASHTO Guide for the Design of Pavement Structures provide load equivalency factors for various axle loads and axle configurations. A structural number (SN) of 3 is assumed and the result is not sensitive to this value. The Terminal Serviceability p_t of 2.0 is considered appropriate for low traffic roads.

Table D.1. Axle Load Equivalency Factors for Flexible Pavements, Single Axles and p_t of 2.0


Axle Load (kips)	Pavement Structural Number (SN)					
	1	2	3	4	5	6
2	.0002	.0002	.0002	.0002	.0002	.0002
4	.002	.003	.002	.002	.002	.002
6	.009	.012	.011	.010	.009	.009
8	.030	.035	.036	.033	.031	.029
10	.075	.085	.090	.085	.079	.076
12	.165	.177	.189	.183	.174	.168
14	.325	.338	.354	.350	.338	.331
16	.589	.598	.613	.612	.603	.596
18	1.00	1.00	1.00	1.00	1.00	1.00
20	1.61	1.59	1.56	1.55	1.57	1.59

D-4

Design of Pavement Structures

Table D.2. Axle Load Equivalency Factors For Flexible Pavements, Tandem Axles and p_t of 2.0

Axle Load (kips)	Pavement Structural Number (SN)					
	1	2	3	4	5	6
2	.0000	.0000	.0000	.0000	.0000	.0000
4	.0003	.0003	.0003	.0002	.0002	.0002
6	.001	.001	.001	.001	.001	.001
8	.003	.003	.003	.003	.003	.002
10	.007	.008	.008	.007	.006	.006
12	.013	.016	.016	.014	.013	.012
14	.024	.029	.029	.026	.024	.023
16	.041	.048	.050	.046	.042	.040
18	.066	.077	.081	.075	.069	.066
20	.103	.117	.124	.117	.109	.105
22	.156	.171	.183	.174	.164	.158
24	.227	.244	.260	.252	.239	.231
26	.322	.340	.360	.353	.338	.329
28	.447	.465	.487	.481	.466	.455
30	.607	.623	.646	.643	.627	.617
32	.810	.823	.843	.842	.829	.819
34	1.06	1.07	1.08	1.08	1.08	1.07
36	1.38	1.38	1.38	1.38	1.38	1.38
38	1.76	1.75	1.73	1.72	1.73	1.74
40	2.22	2.19	2.15	2.13	2.16	2.18
42	2.77	2.73	2.64	2.62	2.66	2.70
44	3.42	3.36	3.23	3.18	3.24	3.31
46	4.20	4.11	3.93	3.83	3.91	4.00

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ESAL for one end-dump truck:

Front tractor single axle (8 kip) = 0.036
Rear tractor tandem axle (36 kip) = 1.38
Rear trailer tandem axle (36 kip) = 1.38

Total ESAL_{End Dump} = 2.80

Total ESAL for the construction activities:

ESAL_{Construction} = (70 trips)(5 days/week)(26 weeks)(2.8) = 25,480

Assuming a design ESAL for the roadway of 400,000, the additional construction activities is expected to use up about 6% of the total life of the roadway.

Check Marriage Road and E. Patrol Road Sections

Compute the TI for the road section using the existing cross section. Compute the total gravel equivalent thickness for the asphalt and base layers. This is computed using the assumed R value for the sub-grade material (R=15). Using equation 16.37 of CE Manual gives:

$$GE = 0.0032(TI)(100-R)$$

Assume an equivalent gravel factor (Gf) of the asphalt of 2.5 from Table 16.18 of CE Manual.

The aggregate base has a Gf of 1.10 from Table 16.18.

$$GE_{provided} = (2" \text{ asphalt})(2.5)/12 + (12" \text{ base})(1.1)/12 = 1.52 \text{ ft}$$


This gives a TI for the section of:

$$TI = GE / [(0.0032)(100-R)]$$

$$TI = 1.52 / [(0.0032)(100-15)] = 5.59 \quad (\text{use } 6.0 \text{ for design})$$

Check the asphalt pavement layer by using the R value of the base of 78.

$$GE_{required} = 0.0032(6.0)(100-78) = .42 \text{ ft}$$

	PROJECT: SITE 27	CALC. No: CALC-MAF-002	REV. 0	DATE: 7/6/05	PAGE 9 of 9
	SUBJECT: Evaluation of Local Roads for Construction Traffic				

Thickness of asphalt required:

$THK_{\text{asphalt}} = 0.42/2.32 = .18 \text{ ft} = 2.16 \text{ in}$ (2 in is provided) therefore, the TI should be 5.5 instead of 6.0.

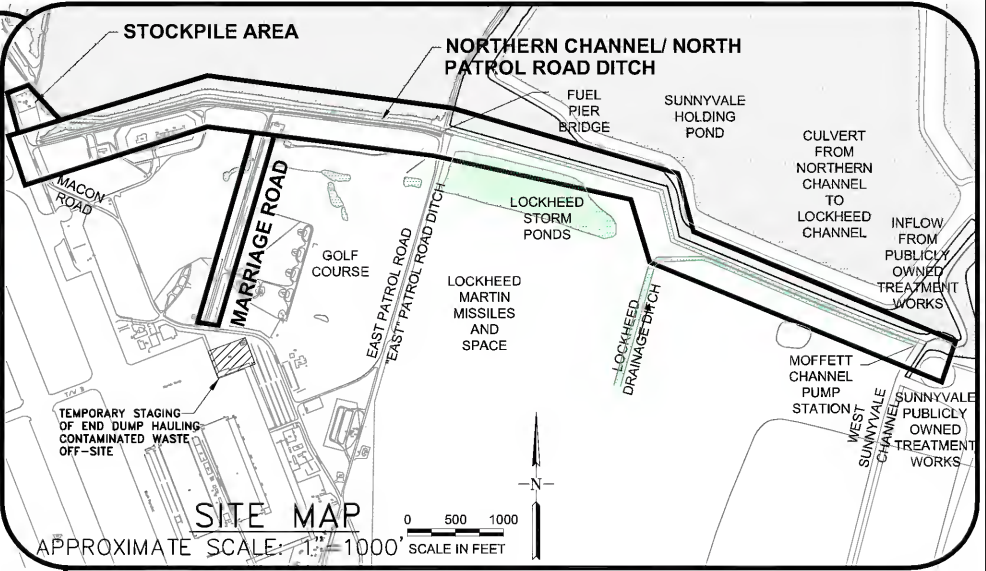
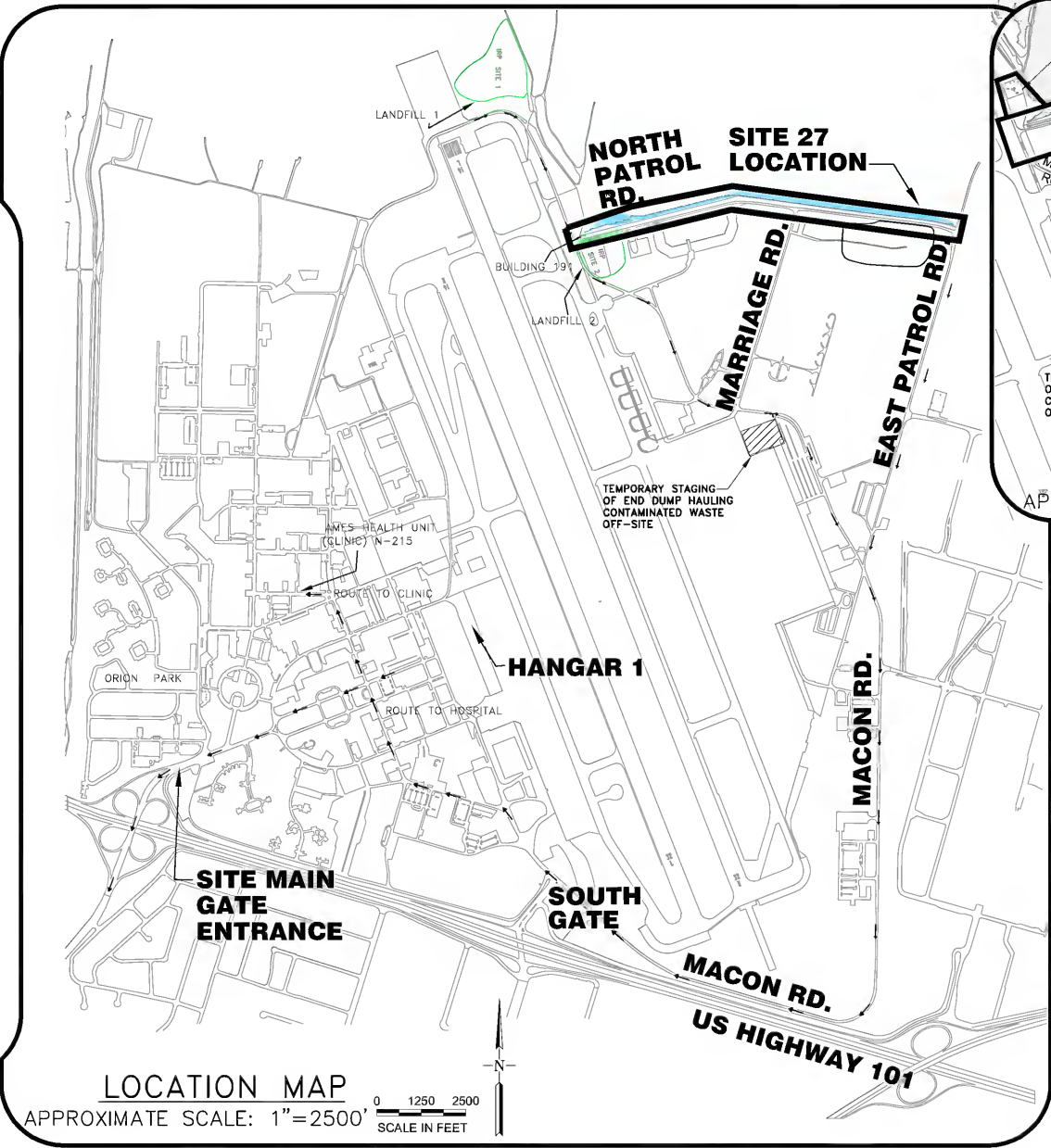
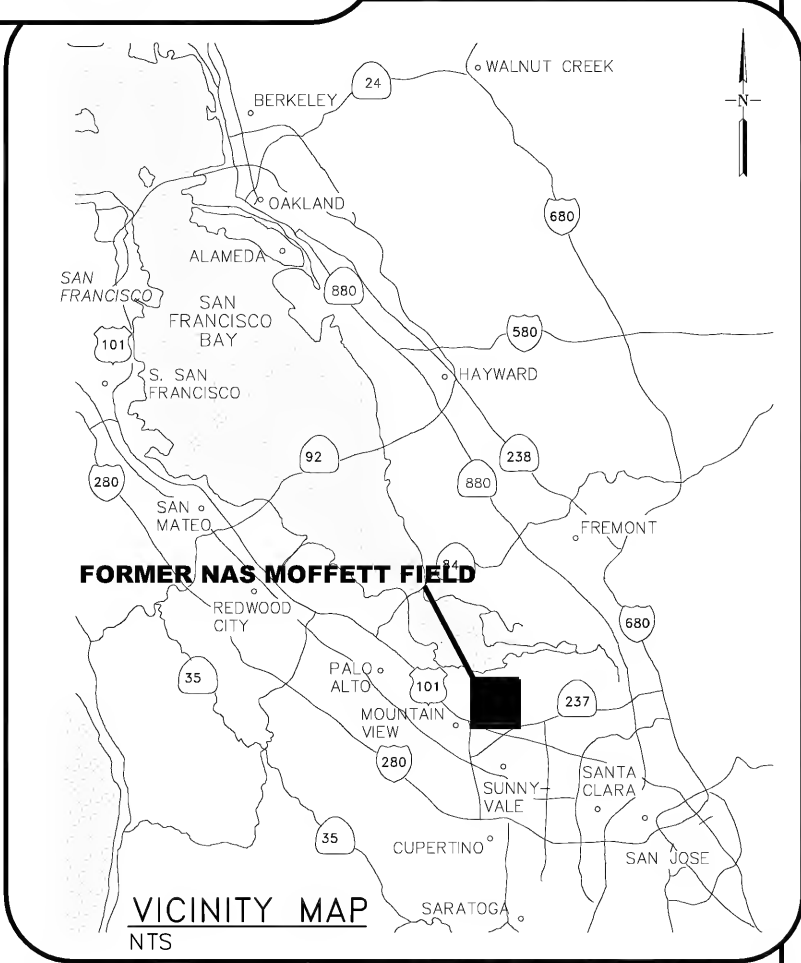
From table 602.4A of the Highway Manual, a TI of 5.5 corresponds to an ESAL value between 10,900 and 23,500

The ESAL construction demand on the pavement is 25,480. Therefore, the construction activity alone is expected to more than deplete the road capacity and significant damage to the pavement is expected. This damage could also extend to the base course.

APPENDIX I

DESIGN DRAWINGS

FORMER NAVAL AIR STATION (NAS)
MOFFETT FIELD
SITE 27
DRAFT FINAL REMEDIAL DESIGN
CONTRACT NO. N68711-04-D-1105



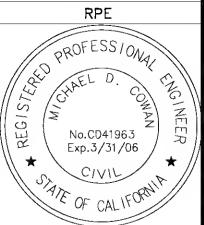
- CONTRACT NO.
- | | |
|---------------|------------------|
| ROICC PE | — G. MUNEKAWA |
| ROICC CMT | — D. SMITH |
| BRAC LEAD RPM | — R. WEISSENBORN |
| BRAC RPM | — S. GROMKO |
| BRAC RTM | — C. BONURA |

FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
TITLE SHEET
AND SITE MAPS

TN & A T N & Associates, Inc.
Engineering and Science

Tt TETRA TECH EC, INC.

SCALE: AS SHOWN	APPROVED	DATE: 12-15-05 (C)
DIVISION: SANTA ANA	MDC	
DRAWN: MD	AE	
CHECKED: HH		



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B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						

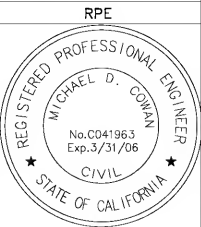
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PLOT/UPDATE: JAN 03 2006 13:56:59

DRAWING LIST

DRAWING NUMBER	DRAWING DESCRIPTION/TITLE	REV
T-1	TITLE SHEET AND SITE MAPS	B
T-2	INDEX OF DRAWINGS	B
T-3	ABBREVIATIONS, LEGEND AND GENERAL NOTES	B
C-1	SITE PLAN	B
C-2	EXISTING TOPOGRAPHIC SURVEY	B
C-3	EROSION CONTROL PLAN/STORMWATER MANAGEMENT PLAN	B
C-4	SEDIMENT STOCKPILE PLAN	B
C-5	CONSTRUCTION ZONE 1 & 2, PLAN AND PROFILE	B
C-6	CONSTRUCTION ZONE 3 & 4, PLAN AND PROFILE	B
C-7	CONSTRUCTION ZONE 5 & 6, PLAN AND PROFILE	B
C-8	CONSTRUCTION ZONE 7 & 8, PLAN AND PROFILE	B
C-9	CONSTRUCTION ZONE 9 & 10 PLAN AND PROFILE	B
C-10	STOCKPILE RETENTION BASIN DETAILS	B
C-11	TURNOUT DETAILS	B
C-12	DEWATERING DETAILS	B
C-13	TRANSECT CROSS SECTIONS 1 THROUGH 12	B
C-14	TRANSECT CROSS SECTIONS 13 THROUGH 25	B
C-15	MARRIAGE ROAD PLAN AND PROFILE STATION 0+00.00 TO 22+90.00	B
C-16	NORTH PATROL ROAD PLAN AND PROFILE STATION 42+22.00 TO 19+00.00	B
C-17	NORTH PATROL ROAD PLAN AND PROFILE STATION 19+00.00 TO 0+00.00	B
C-18	NORTHERN CHANNEL CROSS SECTION-TRANSECT SECTIONS 2,3 AND 4	B
C-19	NORTHERN CHANNEL CROSS SECTIONS-TRANSECT SECTIONS 5, 13 AND 20	B

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B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
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REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
INDEX OF DRAWINGS

TN & A T N & Associates, Inc.
Engineering and Science



SCALE: AS SHOWN	APPROVED MDC	DATE: 12-15-05 (C)
DIVISION: SANTA ANA	AE	T-2
DRAWN: MD		
CHECKED: HH		C

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T-3

ABBREVIATIONS

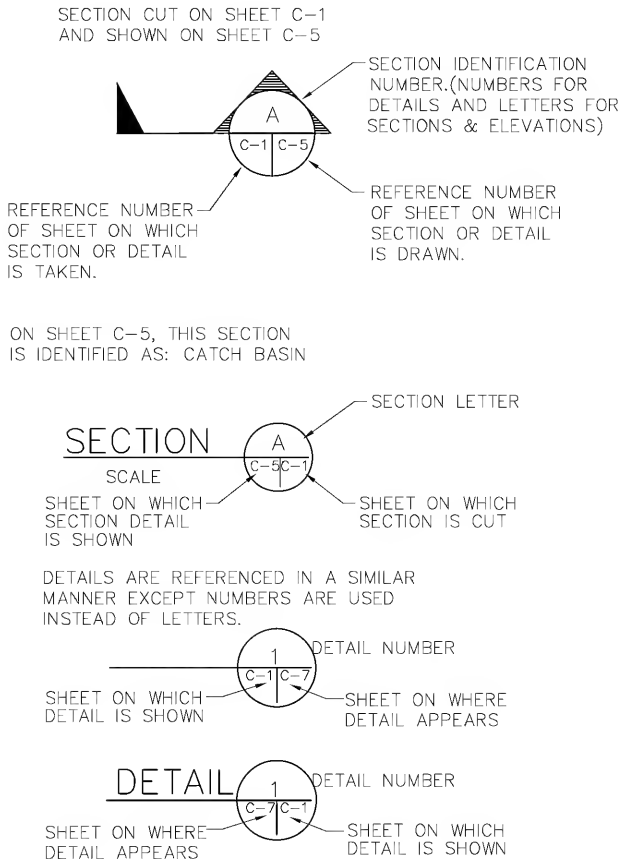
BRAC	BASE REALIGNMENT AND CLOSURE
BVC	BEGINING OF VERTICAL CURVE
EVC	END OF VERTICAL CURVE
CM	CONSTRUCTION MANAGER
CMP	CEMENT MASONRY PIPE
CONC	CONCRETE
CS	CROSS SECTION
DIA	DIAMETER
DWG	DRAWING
E	EAST
EL, ELEV	ELEVATION
EX	EXISTING
FT	FOOT, FEET
FS	FEASIBILITY STUDY
HDPE	HIGH-DENSITY POLYETHYLENE
HOR, HORIZ	HORIZONTAL
ID	INSIDE DIAMETER
IE	INVERT ELEVATION
INV	INVERT
L	LENGTH OF HORIZONTAL CURVE
MAX	MAXIMUM
MH	MANHOLE
MIN	MINIMUM
MSL	MEAN SEA LEVEL
MW	MONITORING WELL
MW	MONITORING WELL
N	NORTH
NTS	NOT TO SCALE
OD	OUTSIDE DIAMETER, OUTSIDE DIMENSION
OZ/YD ²	OUNCE PER SQUARE YARD
PC	POINT OF CURVATURE-HORIZ
PE	PROFESSIONAL ENGINEER
PJM	PROJECT MANAGER
PT	POINT OF TANGENCY-HORIZ
PWR	POWER
R	RADIUS
RCP	REINFORCED CONCRETE PIPE
RCRA	RESOURCE CONSERVATION AND RECOVERY ACT
ROICC	RESIDENT OFFICER IN CHARGE OF CONSTRUCTION
SCH	SCHEDULE
SD	STORM DRAIN
SQ. FT.	SQUARE FOOT
SWPPP	STORM WATER POLLUTION PREVENTION PLAN
T	TANGENT LENGTH, TRANSECT
TELE	TELEPHONE
TYP	TYPICAL
UTIL	UTILITY, UTILITIES
VERT	VERTICAL
WBZ	WATER-BEARING ZONE

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LEGEND

	131.8	SPOT ELEVATION
	211.2	GRADING PLAN SPOT ELEVATION
	(24.3)	EXISTING ELEVATION
		EXISTING INDEX CONTOUR
		EXISTING INTERMEDIATE CONTOUR
		NEW INDEX CONTOUR
		NEW INTERMEDIATE CONTOUR
		FENCE
		CUT EMBANKMENT SLOPE
		SLOPE BREAK LINE
		VEGETATION
		WATER
		SWALE, DITCH
		SLOPE (HORIZ TO VERT)
		DIRECTION OF FLOW
		EXISTING UTILITY POLE
		REVISION IDENTIFICATION
		VALVE
		CHECK VALVE
		SURVEY MONUMENT
		CLEAN OUT
		REMEDIAL PROJECT MANAGER
		REMEDIAL TECHNICAL MANAGER
		TETRA TECH EC., INC.
		TN AND ASSOCIATES
		NAVAL AIR STATION
		HAND/OFF/AUTO
		MOTOR
		LEVEL SWITCH LOW
		LEVEL SWITCH HIGH
		POLYVINYLE CHLORIDE

SYMBOLS



GENERAL NOTES

1. THE CONTRACTOR PRIOR TO START OF WORK SHALL OBTAIN AND REVIEW ALL PERTINENT UTILITY DRAWINGS, SCANNING, LOCATION, AND MARKING ALL UTILITIES, OBTAIN EXCAVATION AND CLEARENCE PERMITS, AND MAKE ALL REQUIRED CONTACTS.

FORMER NAS MOFFETT FIELD SITE 27 DRAFT FINAL REMEDIAL DESIGN ABBREVIATIONS, LEGEND AND GENERAL NOTES

TN & Associates, Inc.
Engineering and Science

TC TETRA TECH EC, INC.

SCALE: AS SHOWN	APPROVED	DATE: 12-15-05 (C)
DIVISION: SANTA ANA	MDC	
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CHECKED: HH		

T-3

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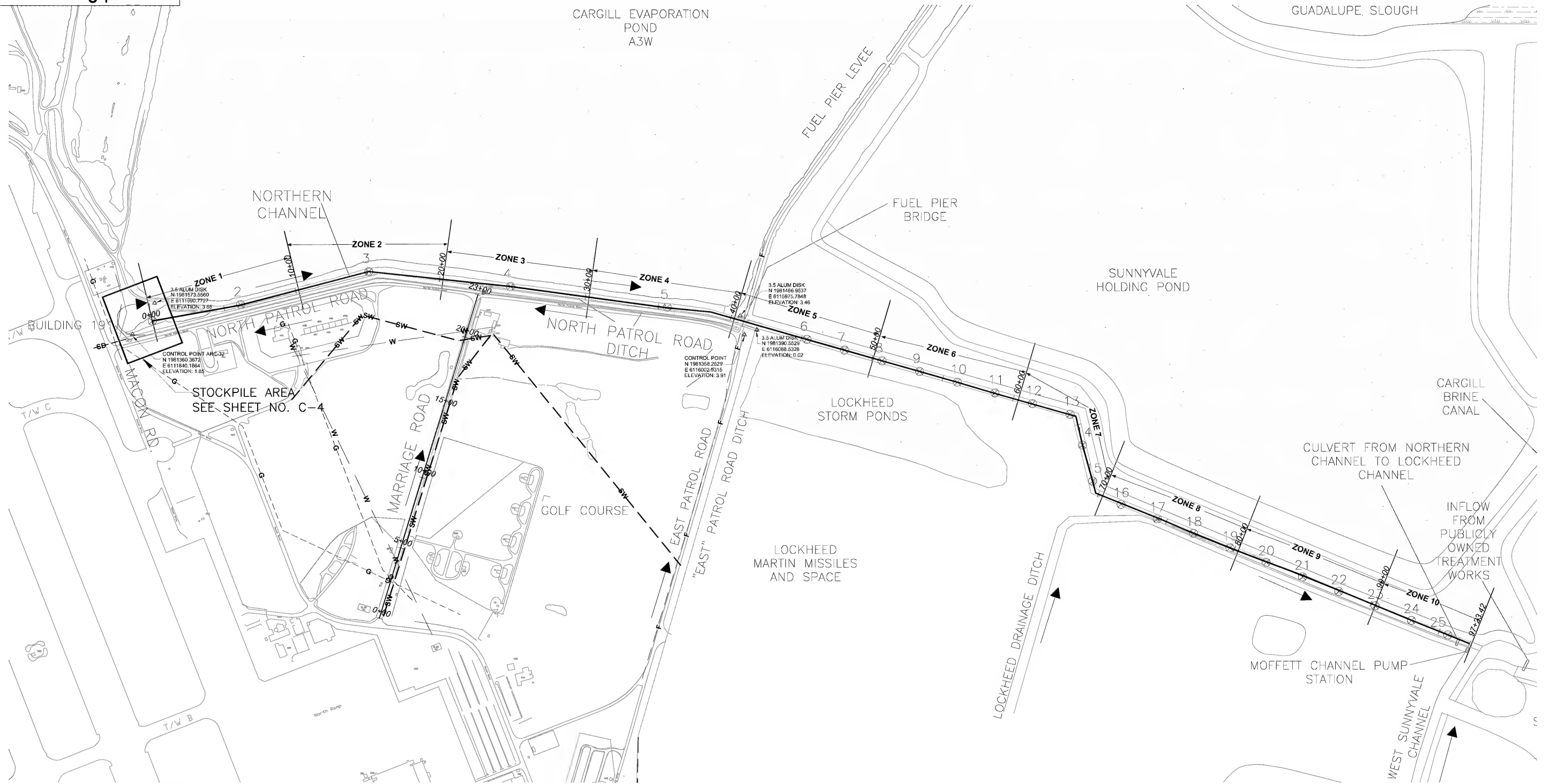
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A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05

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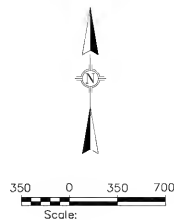
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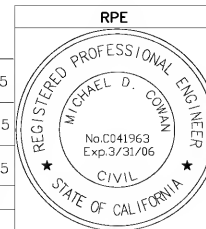
- ▲ SURVEY MONUMENT
- ⊗ TRANSECT SEDIMENT SAMPLE LOCATION AS WELL AS SURFACE WATER AND BIOLOGICAL SAMPLE LOCATION (SEE SHEETS C-12 AND C-13)
- ➔ DIRECTION OF DRAINAGE FLOW
- ▭ SURFACE WATER
- ▨ MARSH LAND

ZONE CONSTRUCTION ZONE WORK AREA TO BE DEWATERED, SEDIMENTS REMOVED, AND FINISH GRADED

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B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
SITE PLAN**

TN & A T N & Associates, Inc.
Engineering and Science

TE TETRA TECH EC, INC.

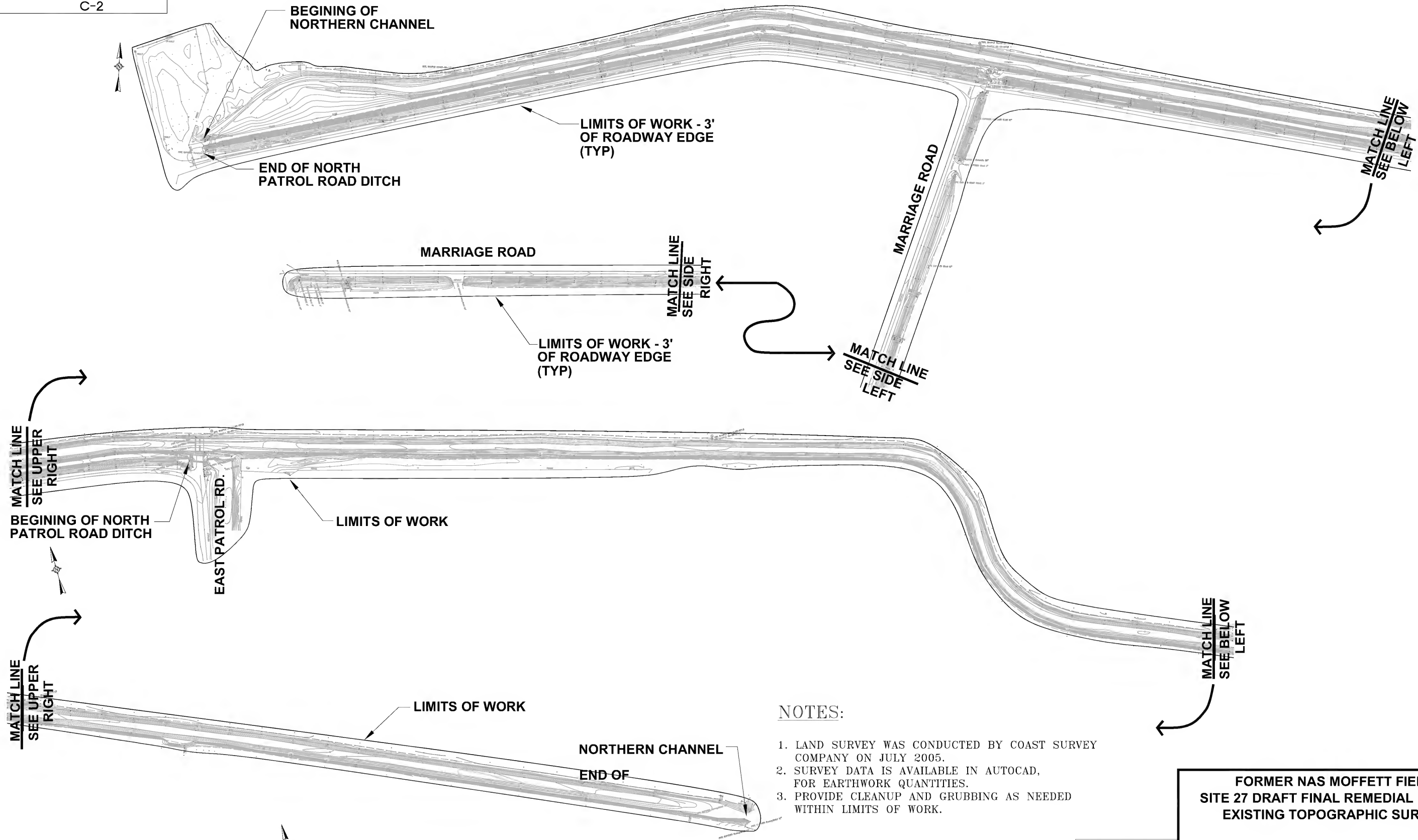
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C-1

C

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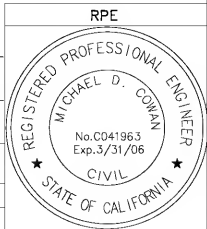
1. LAND SURVEY WAS CONDUCTED BY COAST SURVEY COMPANY ON JULY 2005.
2. SURVEY DATA IS AVAILABLE IN AUTOCAD, FOR EARTHWORK QUANTITIES.
3. PROVIDE CLEANUP AND GRUBBING AS NEEDED WITHIN LIMITS OF WORK.

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REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
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B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05

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**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
EXISTING TOPOGRAPHIC SURVEY**

TN & Associates, Inc.
Engineering and Science

TETRA TECH EC, INC.

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DIVISION: SANTA ANA	AE	
DRAWN: MD		
CHECKED: HH		

C-2

C

DRAWING NUMBER:
C-3

FLOATING TURBIDITY CURTAIN (SEE NOTES AND DETAILS ON SHEET C 12)

NORTHERN CHANNEL

SILT FENCE 3' OFF EDGE ON NORTH BERM HAUL RD. NORTH SIDE

FUEL PIER BRIDGE

SUNNYVALE HOLDING POND

SUNNYVALE HOLDING POND

CARGILL BRINE CANAL

CULVERT FROM NORTHERN CHANNEL TO LOCKHEED CHANNEL

INFLOW FROM PUBLICLY OWNED TREATMENT WORKS

FLOATING TURBIDITY CURTAIN (SEE NOTES AND DETAILS ON SHEET C 12)

MOFFETT CHANNEL PUMP STATION

PROVIDE MAINTENANCE TO GATE/CHECK GATE AND PROTECT INLET AS NEEDED WITH SILT FENCES IN CHANNEL

SUNNYVALE PUBLICLY OWNED TREATMENT WORKS

WEST SUNNYVALE CHANNEL

LEGEND:

- SILT FENCE
- FLOATING TURBIDITY CURTAIN
- 1" GRAVEL AREA
- DIRECTION OF DRAINAGE FLOW
- SURFACE WATER
- MARSH LAND

NOTES:

1. FLOATING TURBIDITY CURTAIN TO BE RELOCATED ONE ZONE DOWNSTREAM OF CONSTRUCTION ACTIVE ZONE. IT WILL CONSTANTLY BE RELOCATED WITH THE PROGRESS OF EXCAVATION ACTIVITY.
2. A SECOND FLOATING TURBIDITY CURTAIN TO BE LOCATED IN ZONE 10 DOWNSTREAM OF ALL CONSTRUCTION ZONES AT ALL TIMES.
3. AFTER SEDIMENT REMOVAL DITCH MAY BE USED AS A RETENTION BASIN.

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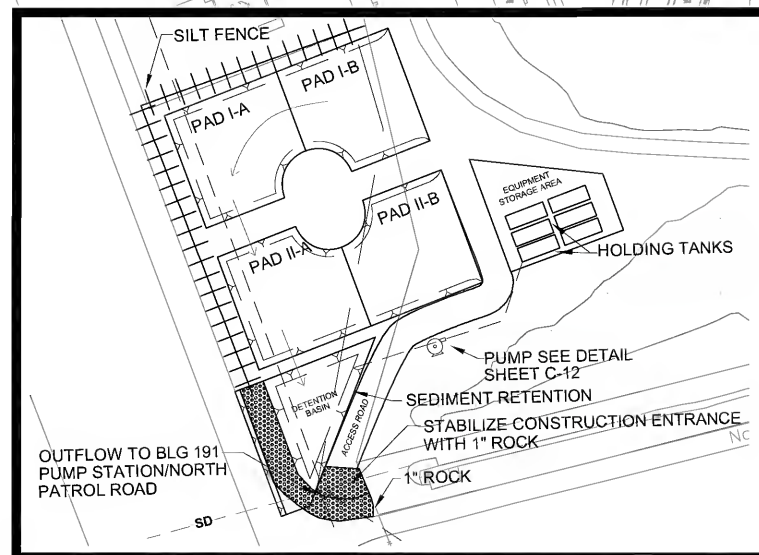
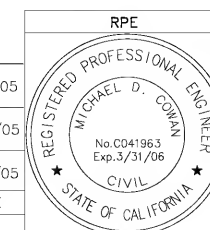
**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
EROSION CONTROL PLAN/
STORMWATER MANAGEMENT PLAN**

TN & Associates, Inc.
Engineering and Science

TETRA TECH EC, INC.

SCALE: AS SHOWN
DIVISION: SANTA ANA
DRAWN: MD
CHECKED: HH
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DATE: 12-15-05 (C)
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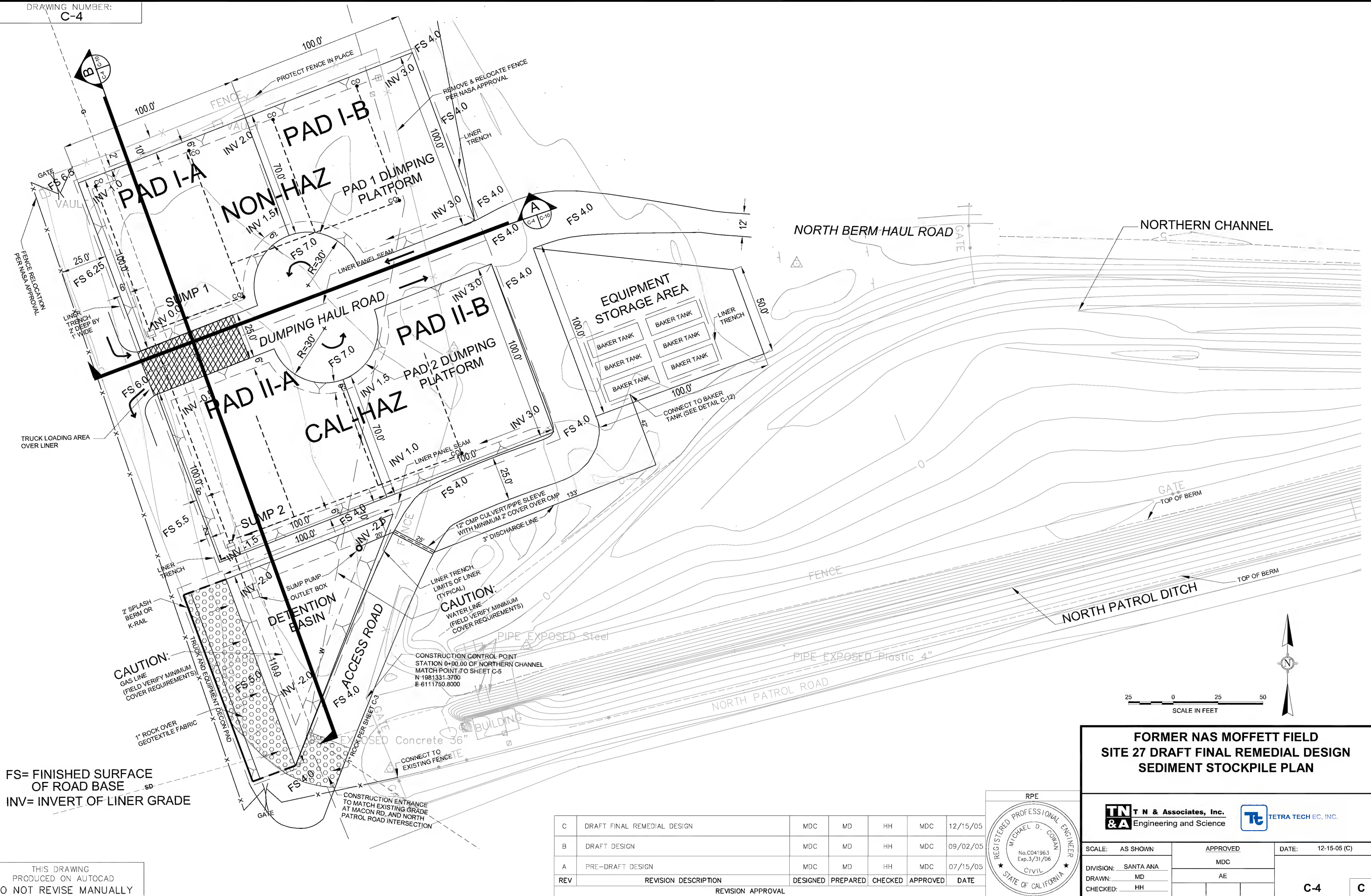
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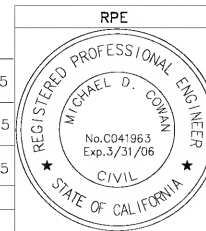
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C-4



FS= FINISHED SURFACE
OF ROAD BASE
INV= INVERT OF LINER GRADE

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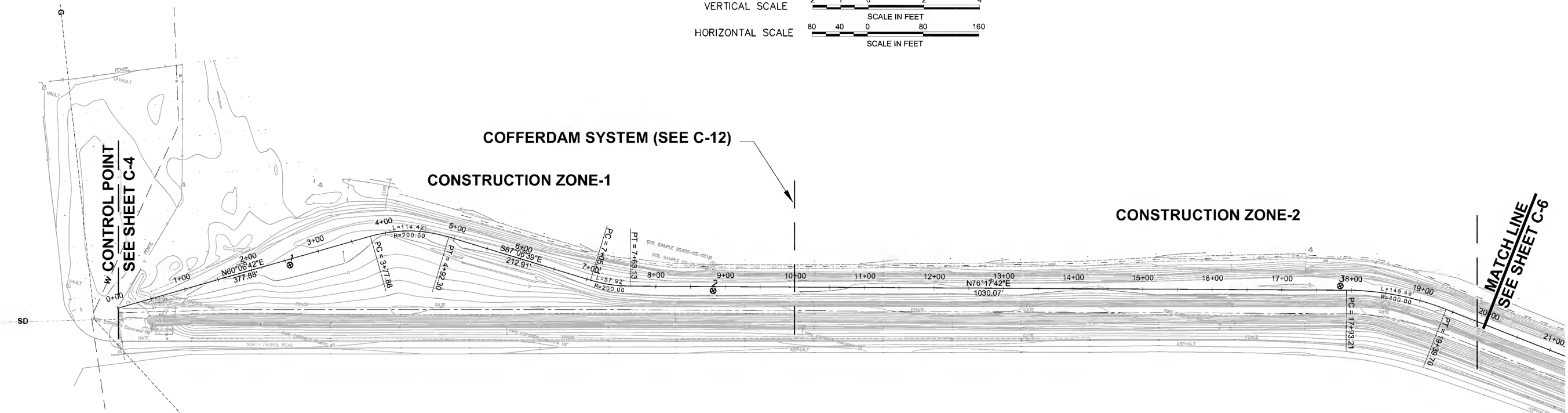
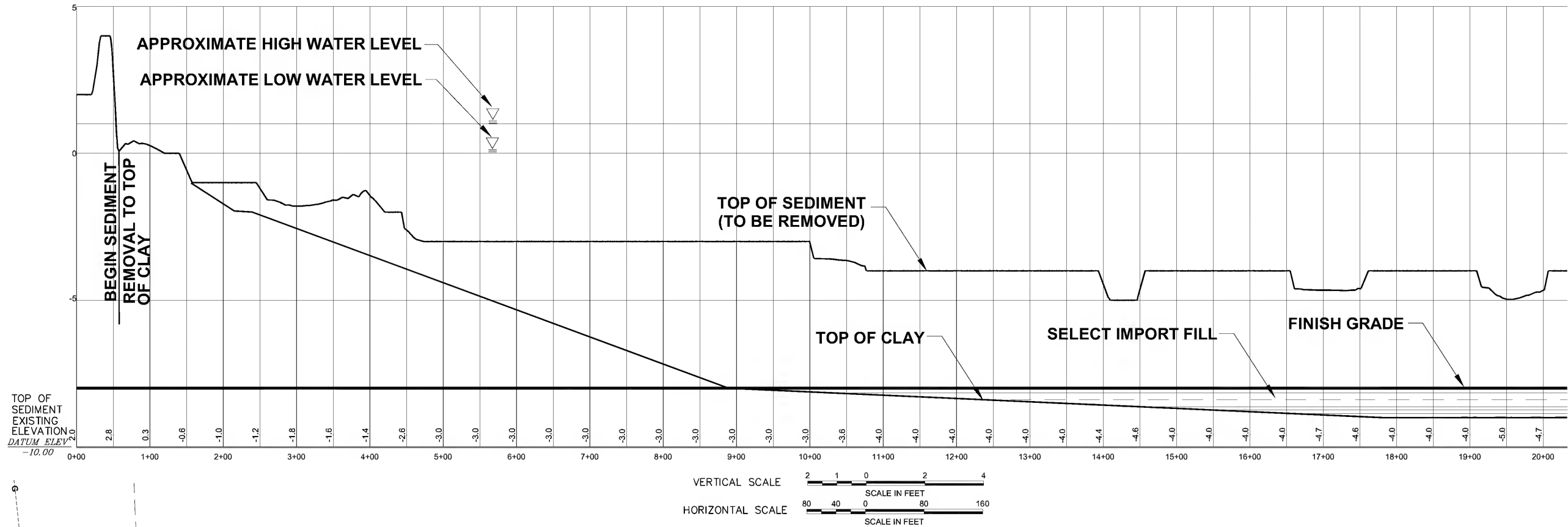
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A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
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FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
SEDIMENT STOCKPILE PLAN

TN & Associates, Inc. Engineering and Science		TETRA TECH EC, INC.	
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C-5

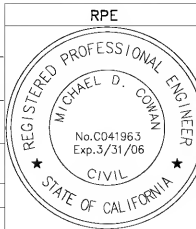


LEGEND

- ⊗ TRANSECT CROSS SECTION LOCATIONS & NUMBER
SEE SHEETS C13 AND C14

NORTHERN CHANNEL PLAN AND PROFILE

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A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE



FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
CONSTRUCTION ZONE 1 & 2,
PLAN AND PROFILE

TN & A T N & Associates, Inc.
Engineering and Science

TE TETRA TECH EC, INC.

SCALE: AS SHOWN	APPROVED MDC	DATE: 12-15-05 (C)
DIVISION: SANTA ANA	AE	
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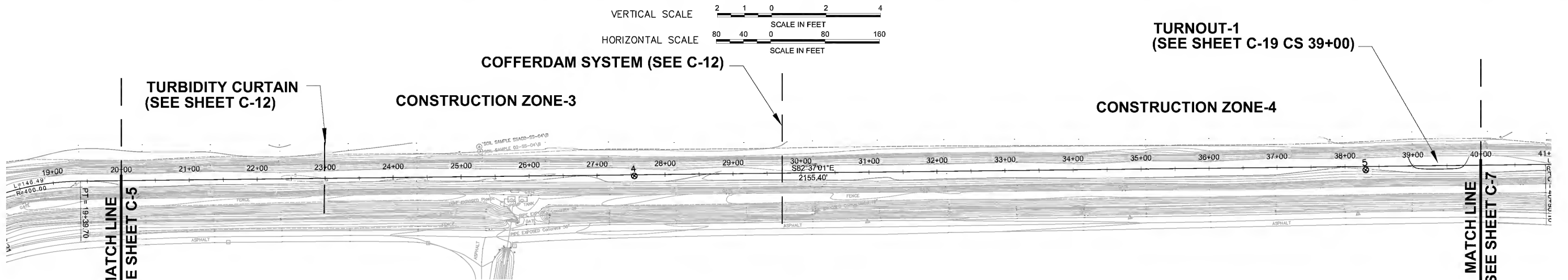
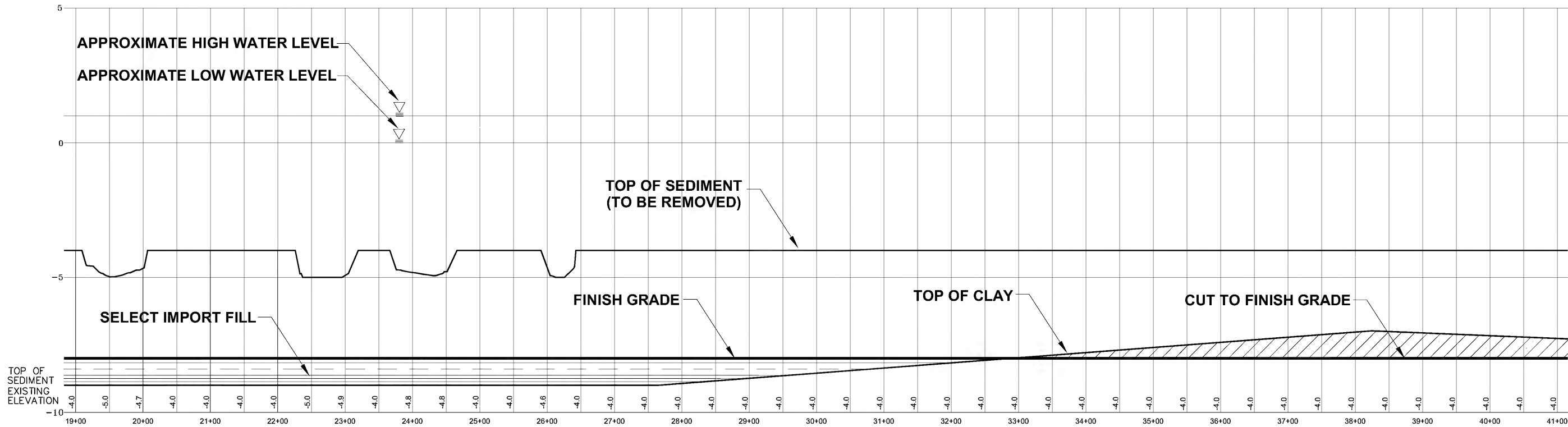
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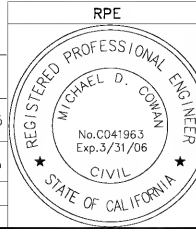
NORTHERN CHANNEL PLAN AND PROFILE

LEGEND

⊗ TRANSECT CROSS SECTION LOCATIONS & NUMBER
SEE SHEETS C13 AND C14

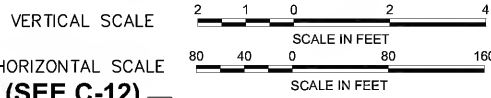
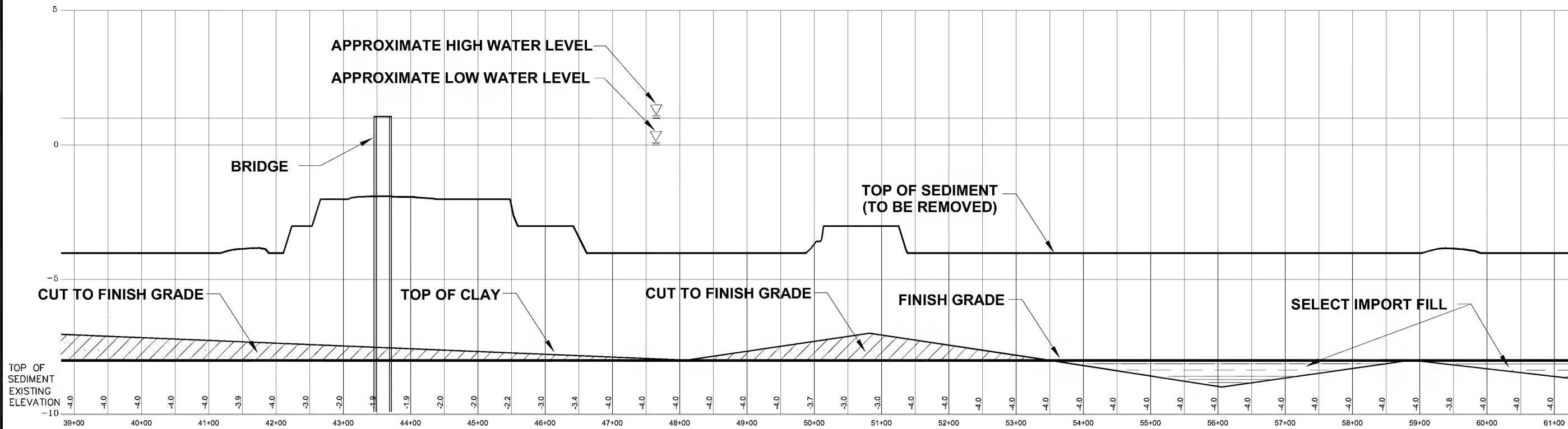


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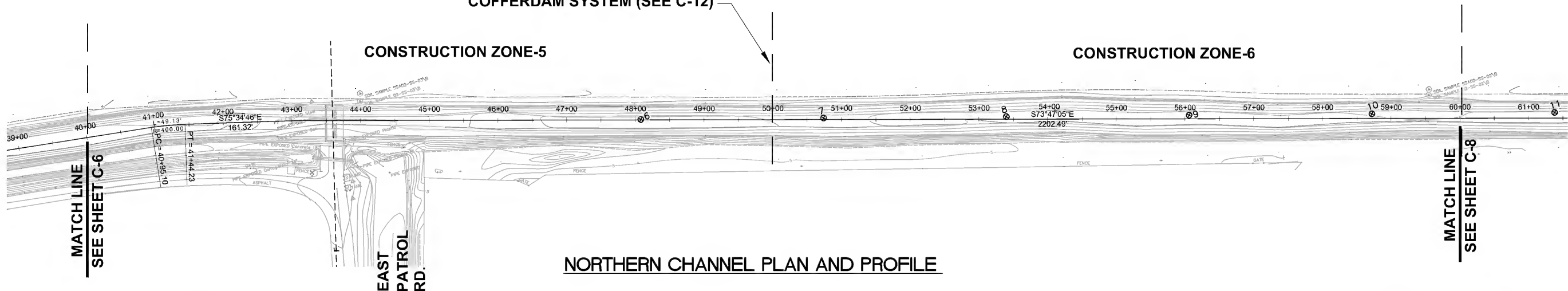


**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
CONSTRUCTION ZONE 3 & 4,
PLAN AND PROFILE**

TN & A T N & Associates, Inc. Engineering and Science		Tt TETRA TECH EC, INC.	
SCALE: AS SHOWN	APPROVED	DATE: 12-15-05 (C)	
DIVISION: SANTA ANA	MDC	C-6	
DRAWN: MD	AE		
CHECKED: HH		C	



COFFERDAM SYSTEM (SEE C-12)



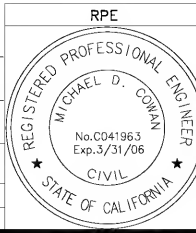
NORTHERN CHANNEL PLAN AND PROFILE

LEGEND

- ⊗ TRANSECT CROSS SECTION LOCATIONS & NUMBER
SEE SHEETS C13 AND C14



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B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
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**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
CONSTRUCTION ZONE 5 & 6,
PLAN AND PROFILE**

TN & A T N & Associates, Inc.
Engineering and Science

Tt TETRA TECH EC, INC.

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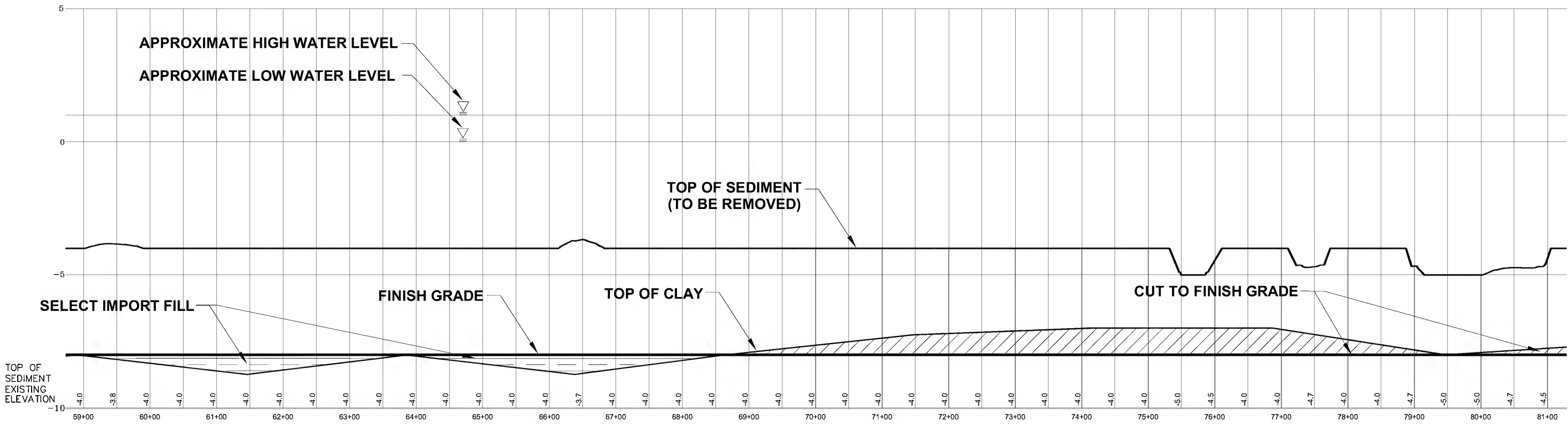
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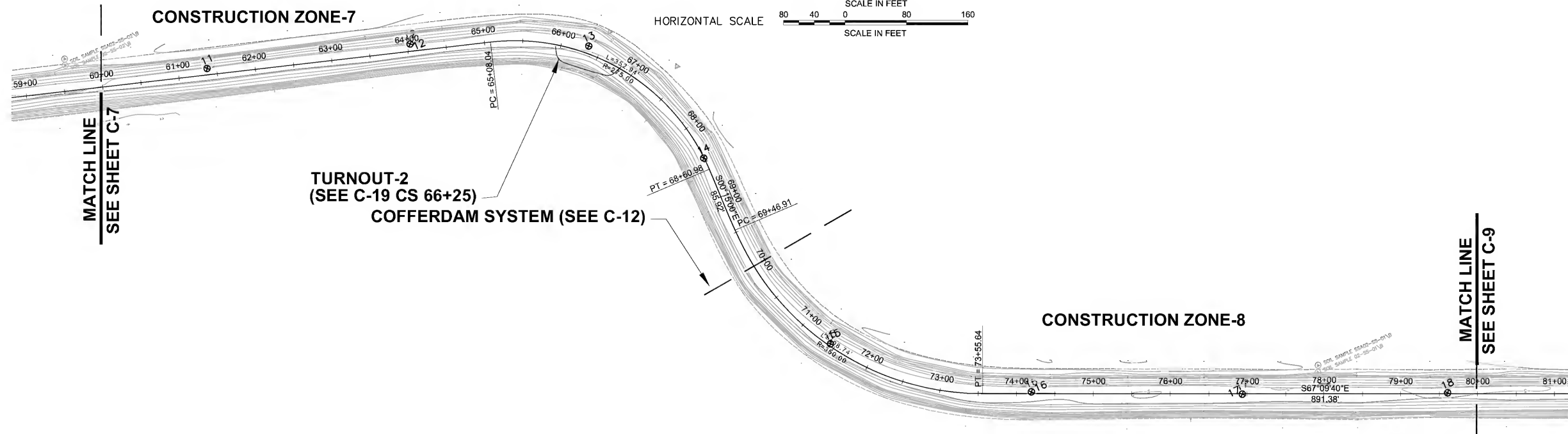
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C-8



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HORIZONTAL SCALE 80 40 0 80 160
SCALE IN FEET

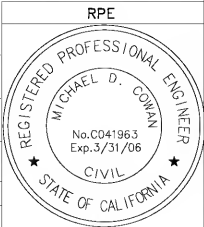


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⊗ TRANSECT CROSS SECTION LOCATIONS & NUMBER
SEE SHEETS C13 AND C14

NORTHERN CHANNEL PLAN AND PROFILE

C	DRAFT FINAL REMEDIAL DESIGN	MDC	MD	HH	MDC	12/15/05
B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
CONSTRUCTION ZONE 7 & 8,
PLAN AND PROFILE**

TN & Associates, Inc.
Engineering and Science

Tt **TETRA TECH EC, INC.**

SCALE: AS SHOWN	APPROVED MDC	DATE: 12-15-05 (C)
DIVISION: SANTA ANA	AE	
DRAWN: MD		
CHECKED: HH		

C-8

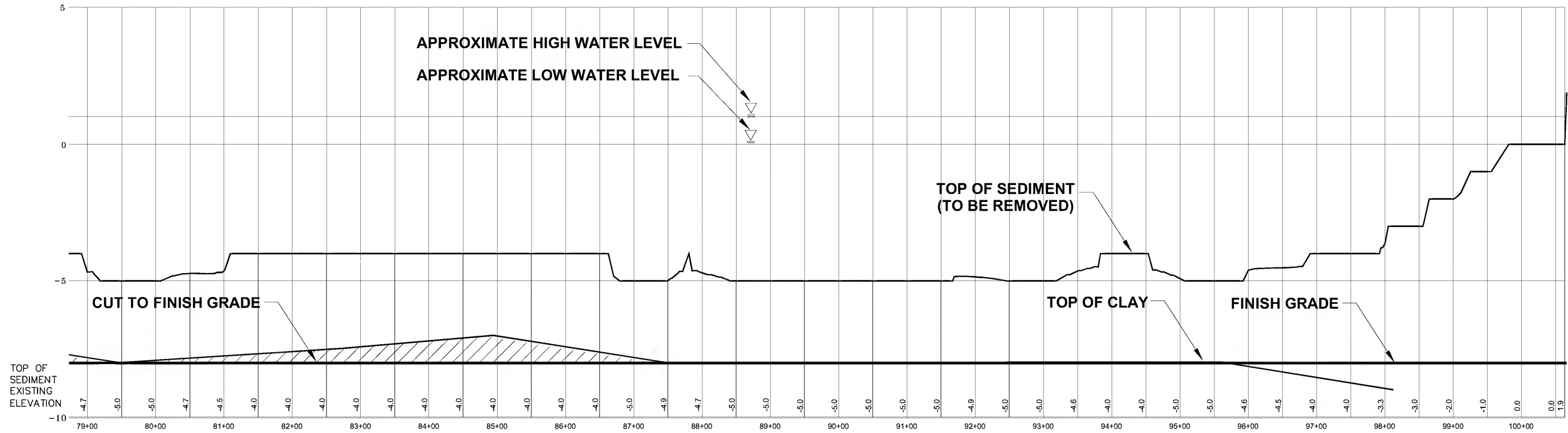
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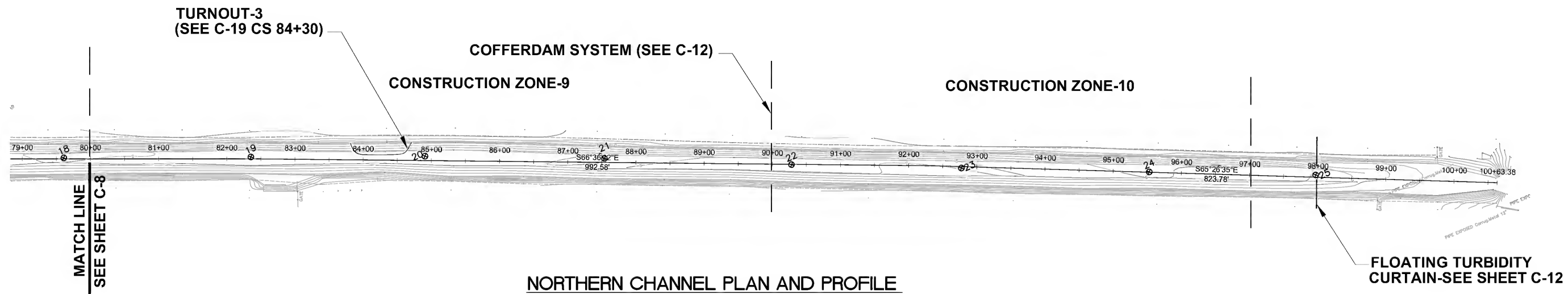
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DO NOT REVISE MANUALLY

80 40 0 80 160
SCALE IN FEET

DRAWING NUMBER:
C-9



VERTICAL SCALE: 2 1 0 2 4
SCALE IN FEET
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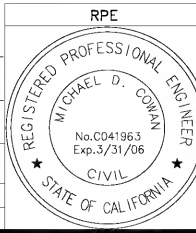


NORTHERN CHANNEL PLAN AND PROFILE

LEGEND
⊗ TRANSECT CROSS SECTION LOCATIONS & NUMBER
SEE SHEETS C13 AND C14

80 40 0 80 160
SCALE IN FEET

C	DRAFT FINAL REMEDIAL DESIGN	MDC	MD	HH	MDC	12/15/05
B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
CONSTRUCTION ZONE 9 & 10,
PLAN AND PROFILE**

TN & Associates, Inc.
Engineering and Science

TETRA TECH EC, INC.

SCALE: AS SHOWN
DIVISION: SANTA ANA
DRAWN: MD
CHECKED: HH

APPROVED
MDC
AE

DATE: 12-15-05 (C)

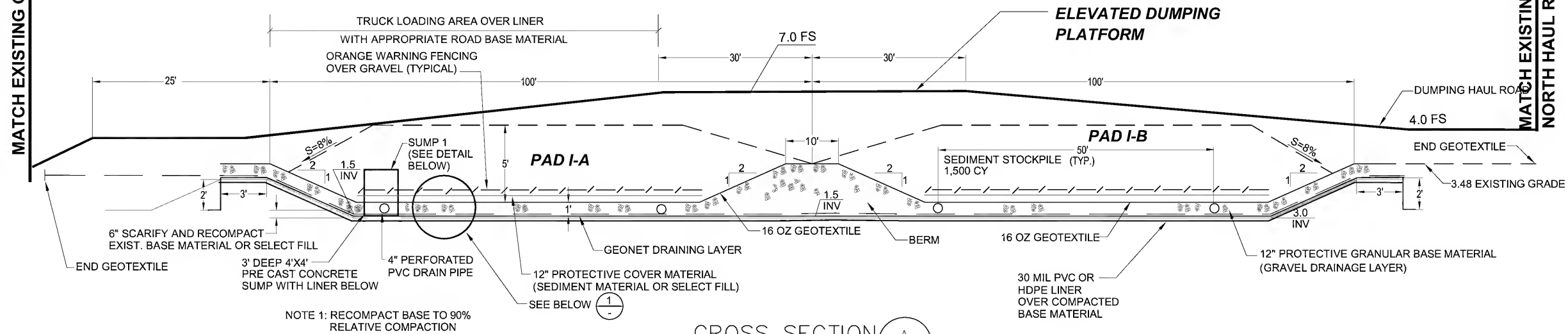
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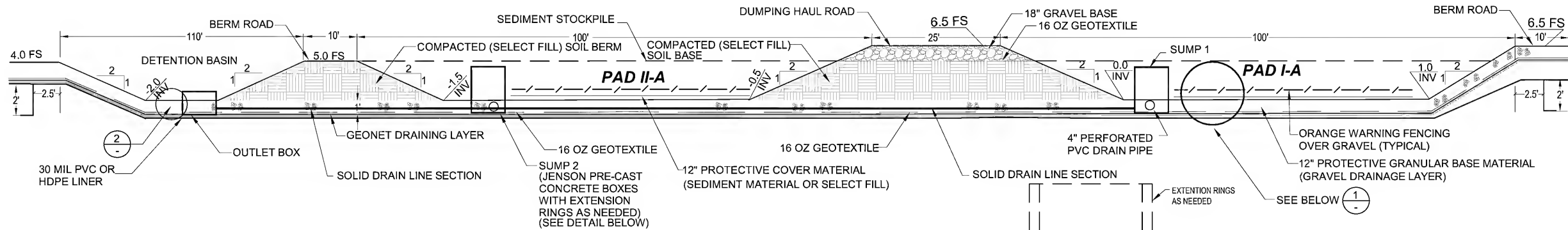
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DO NOT REVISE MANUALLY

MATCH EXISTING GRADE

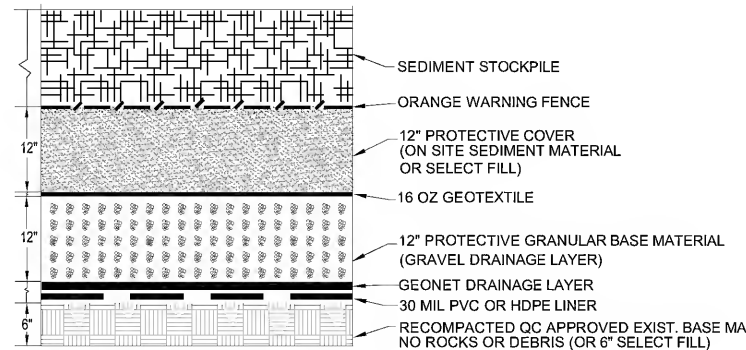
MATCH EXISTING GRADE
NORTH HAUL ROAD



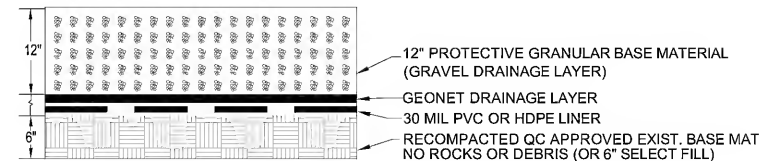
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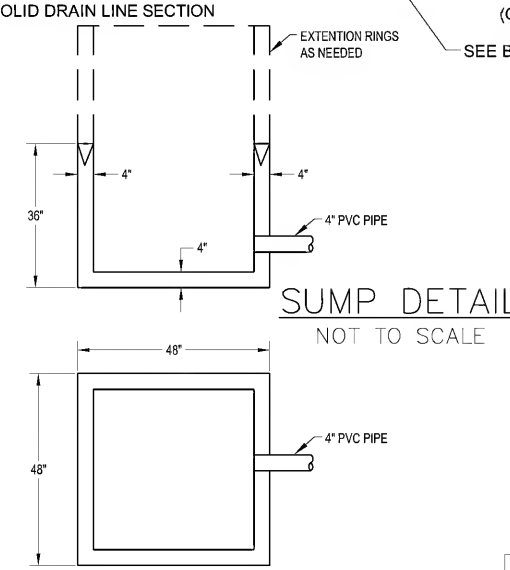
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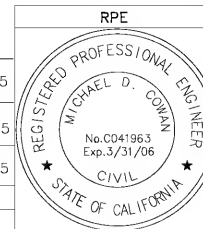


2



SUMP DETAIL
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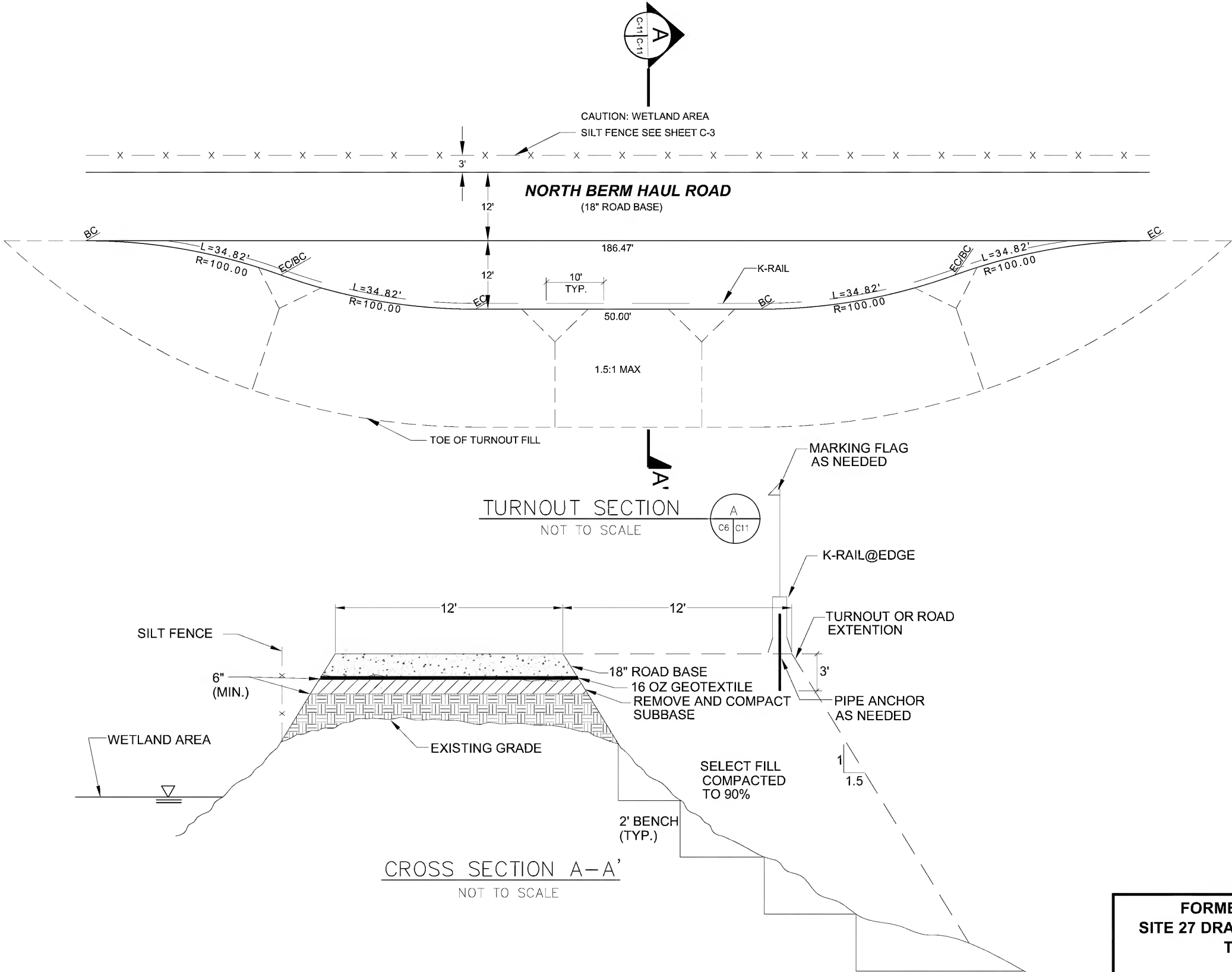
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B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



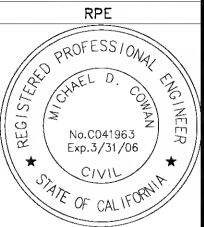
FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
STOCKPILE RETENTION BASIN DETAILS

TNT & Associates, Inc. Engineering and Science		TETRA TECH EC, INC.	
SCALE: AS SHOWN	APPROVED	DATE: 12-15-05 (C)	
DIVISION: SANTA ANA	MDC	C-10	
DRAWN: MD	AE		
CHECKED: HH		C	

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DO NOT REVISE MANUALLY



C	DRAFT FINAL REMEDIAL DESIGN	MDC	MD	HH	MDC	12/15/05
B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
TURNOUT DETAILS

TNT & Associates, Inc.
Engineering and Science

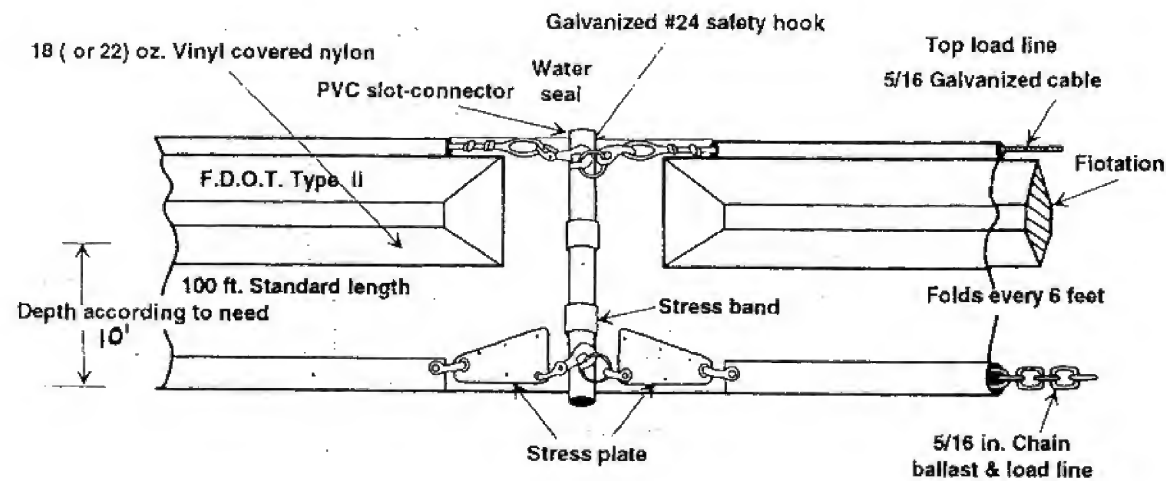
Tt **TETRA TECH EC, INC.**

SCALE: AS SHOWN	APPROVED	DATE: 12-15-05 (C)
DIVISION: SANTA ANA	MDC	C-11
DRAWN: MD	AE	
CHECKED: HH		

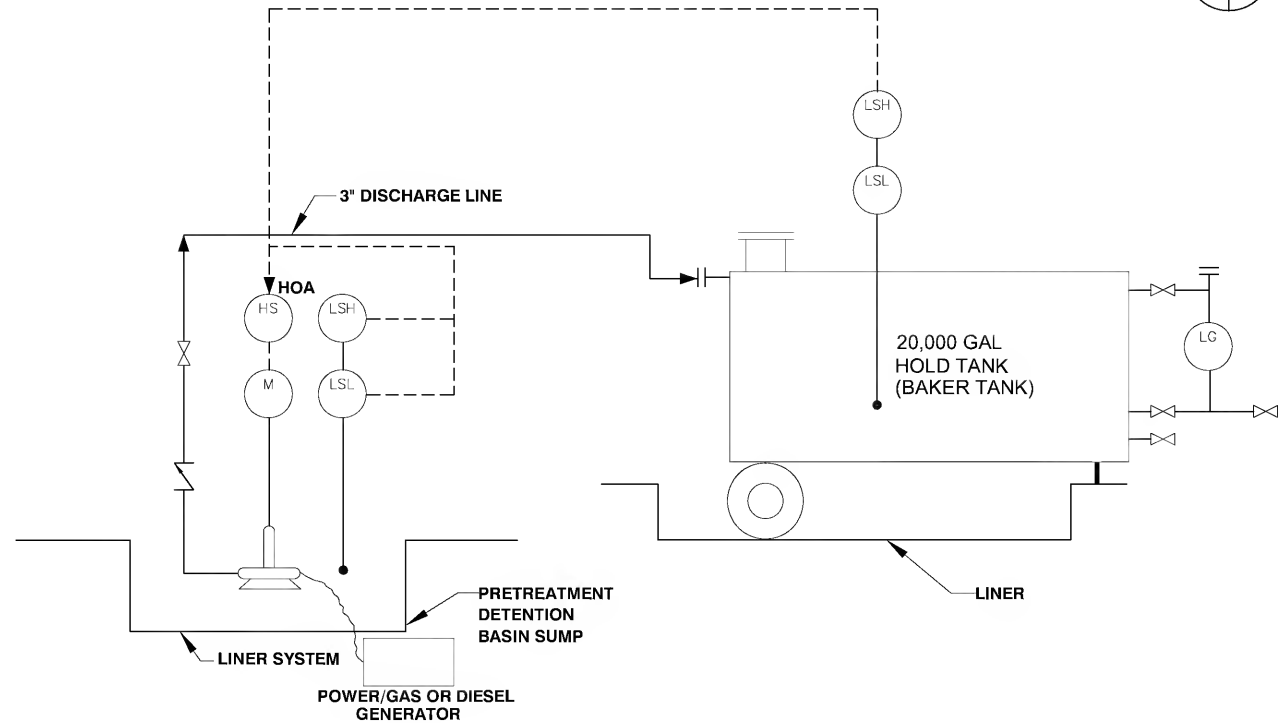
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THIS DRAWING
PRODUCED ON AUTOCAD
DO NOT REVISE MANUALLY



TURBIDITY CURTAIN (PORTADAM[®], INC. OR EQUIVALENT)
NOT TO SCALE



SUBMERSIBLE SUMP PUMP

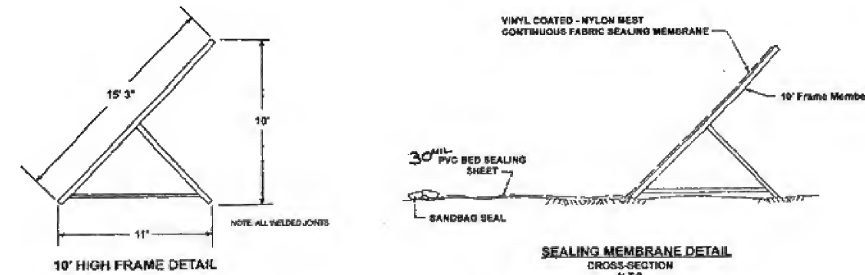
HOA HAND/OFF/AUTO
M MOTOR
LG LEVEL GAUGE
LSH LEVEL SWITCH HIGH
LSL LEVEL SWITCH LOW
X VALVE
✓ CHECK VALVE

(GOULD'S MODEL LDN OR LEP, DEPENDING ON THE SOLIDS LOADING. SEE THE ATTACHED SPEC.)

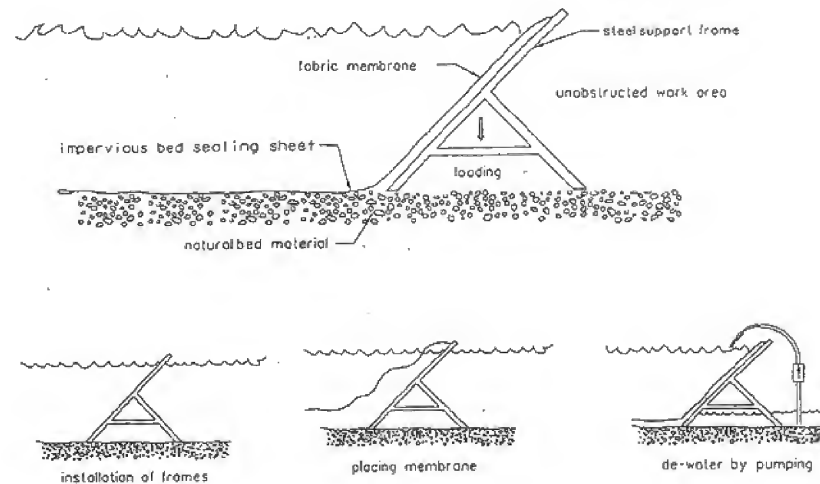
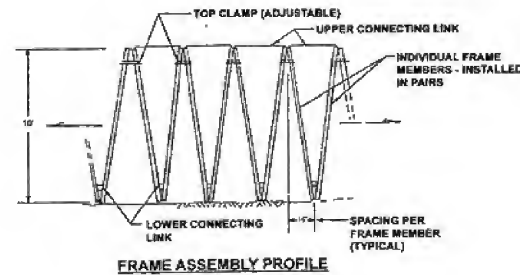
SCENARIO

1. SUMP PUMP IS ON WHEN THE SUMP LEVEL IS HIGH.
2. SUMP PUMP IS OFF WHEN THE SUMP LEVEL IS LOW.
3. SUMP PUMP IS OFF WHEN THE TANK LEVEL IS HIGH. THIS OVER RIDES # 1.

PRE-TREATMENT DETENTION BASIN SCHEMATIC
NOT TO SCALE

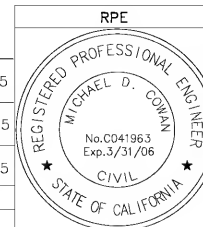


- NOTES:
1. OPTIONAL ATTACHMENTS
 - BACK BRACE POLE
 - HORIZONTAL ADDITIONAL BRACING
 - SINGLE FRAME ATTACHMENTS FOR IRREGULAR CONTOURS & TURNS
 2. ANCHOR BOLTS MAY BE REQUIRED ON HARD ROCK, FLAT OR CONCRETE SURFACES.



COFFERDAM SYSTEM (PORTADAM[®], INC. OR EQUIVALENT)
NOT TO SCALE

C	DRAFT FINAL REMEDIAL DESIGN	MDC	MD	HH	MDC	12/15/05
B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE



**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
DEWATERING DETAILS**

TN & Associates, Inc.
Engineering and Science

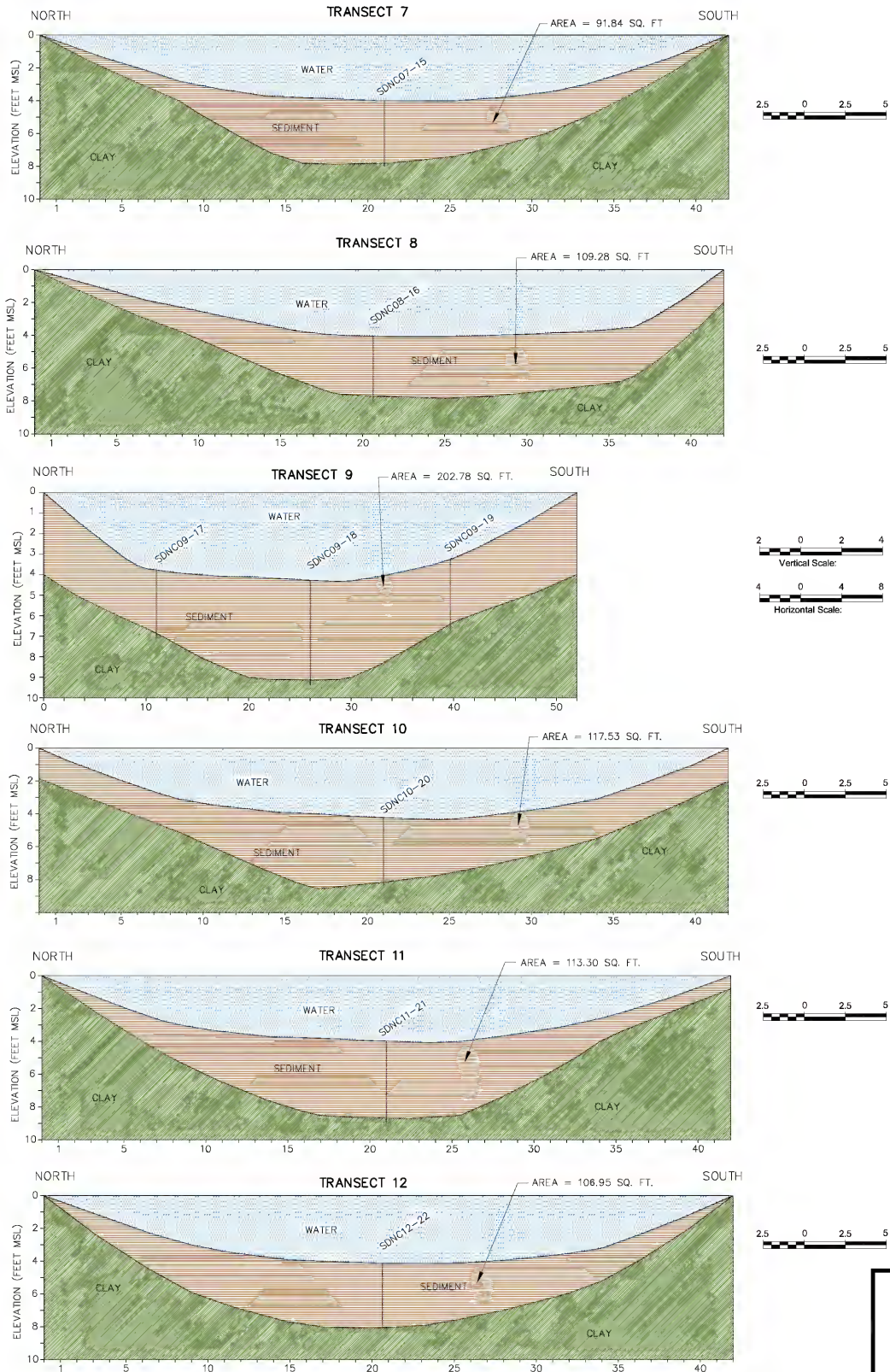
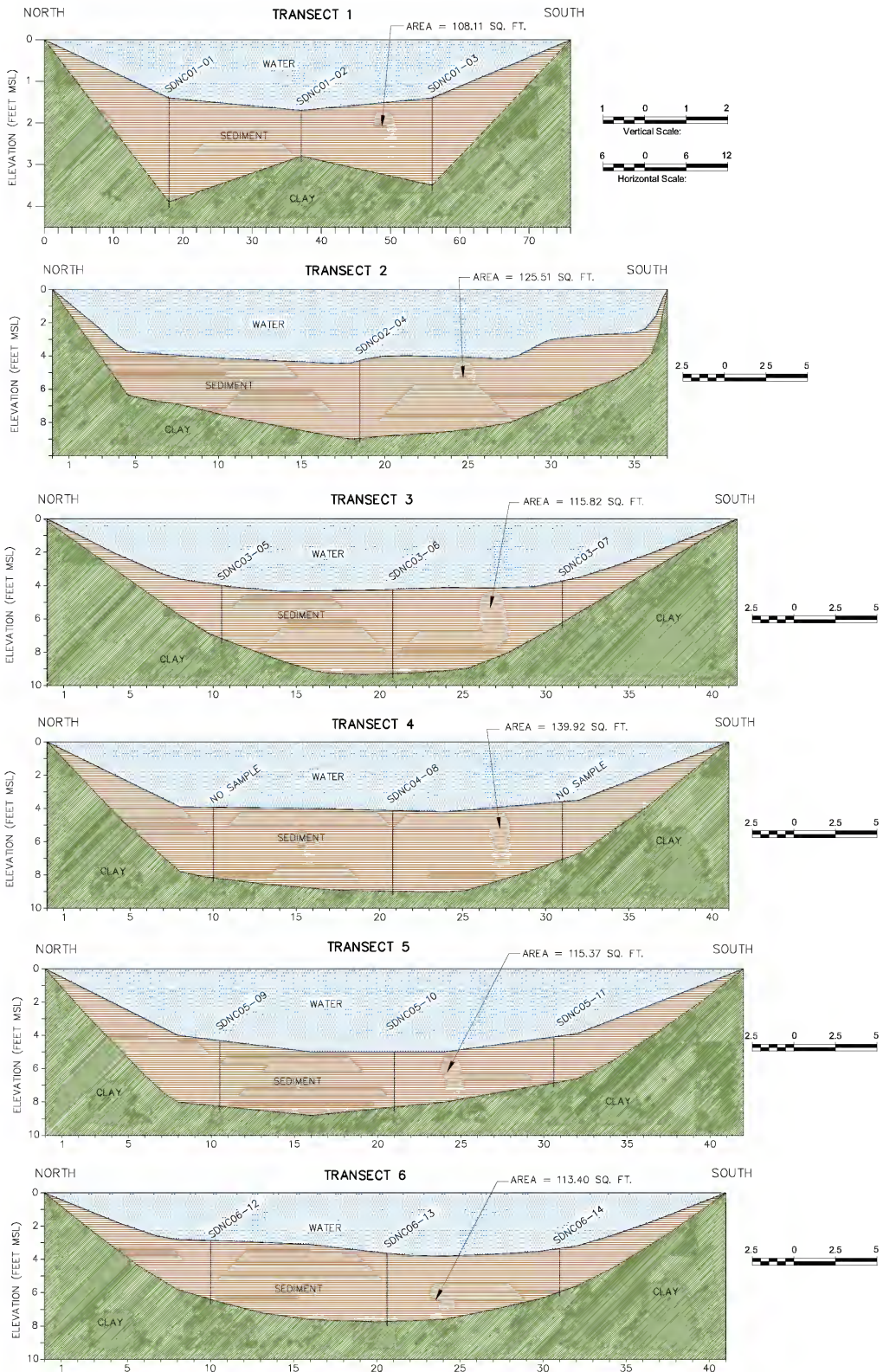
TETRA TECH EC, INC.

SCALE: AS SHOWN
APPROVED: MDC
DATE: 12-15-05 (C)
DIVISION: SANTA ANA
DRAWN: MD
CHECKED: HH

C-12 **C**

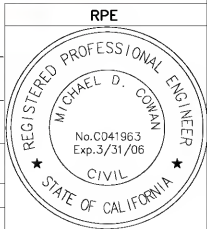
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DRAWING NUMBER:
C-13



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DO NOT REVISE MANUALLY

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B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
TRANSECT CROSS SECTIONS
1 THROUGH 12**

TN & A T N & Associates, Inc.
Engineering and Science

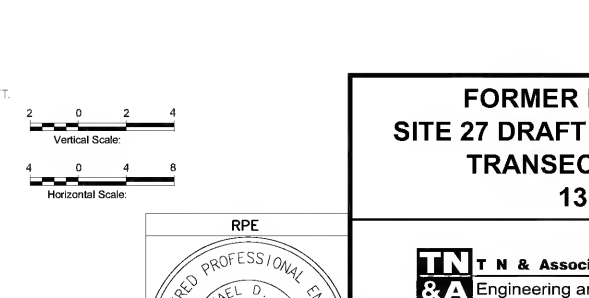
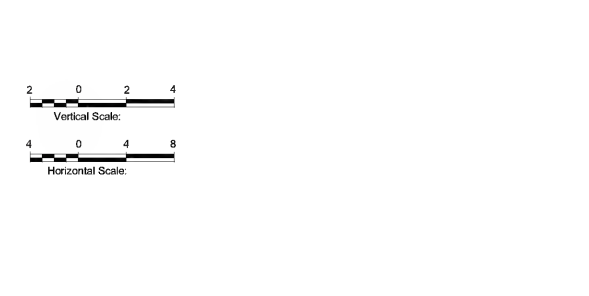
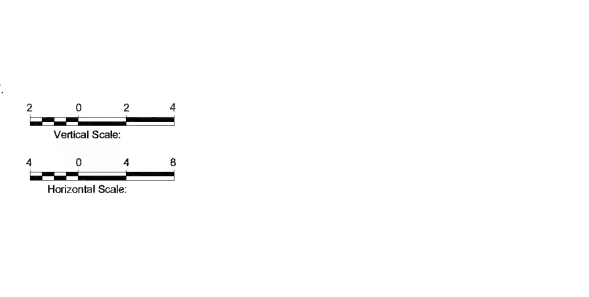
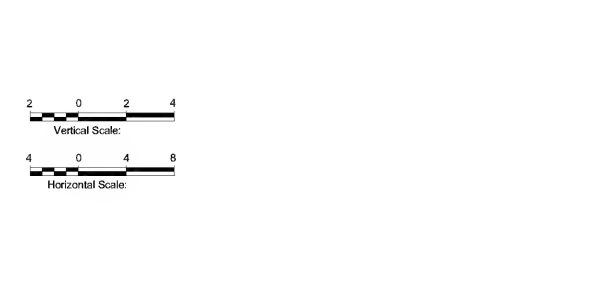
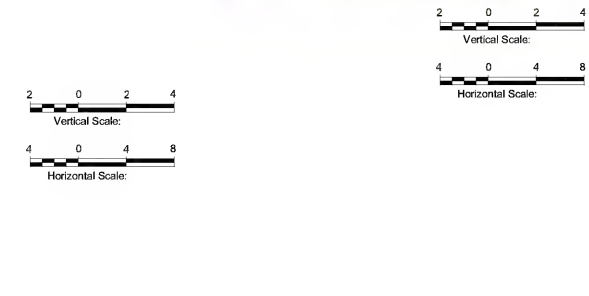
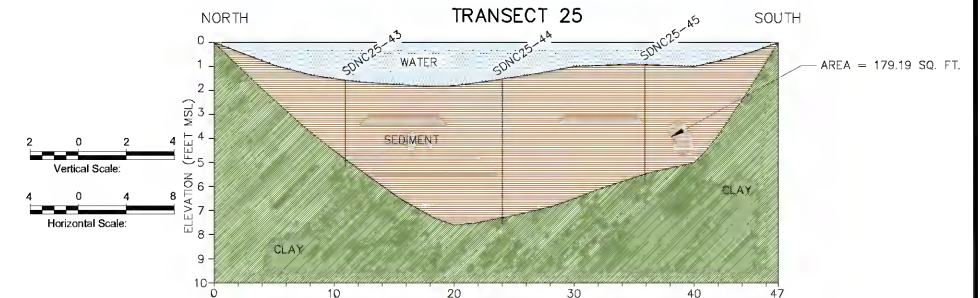
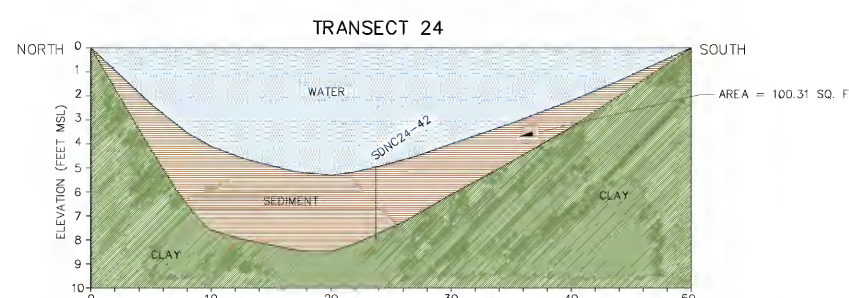
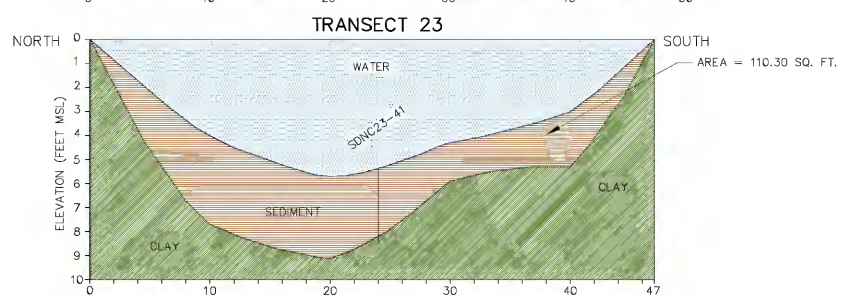
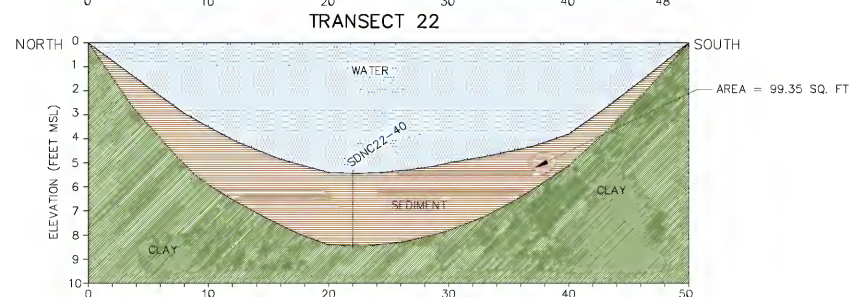
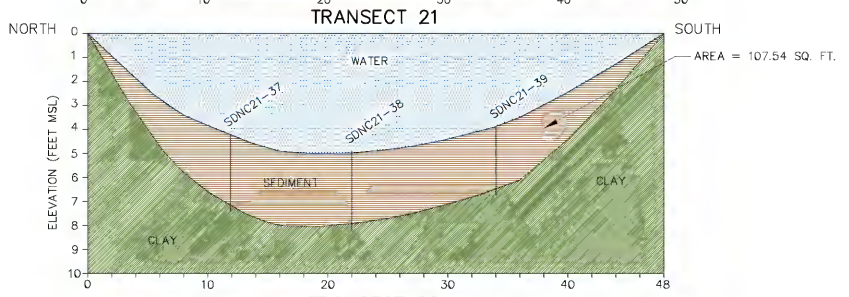
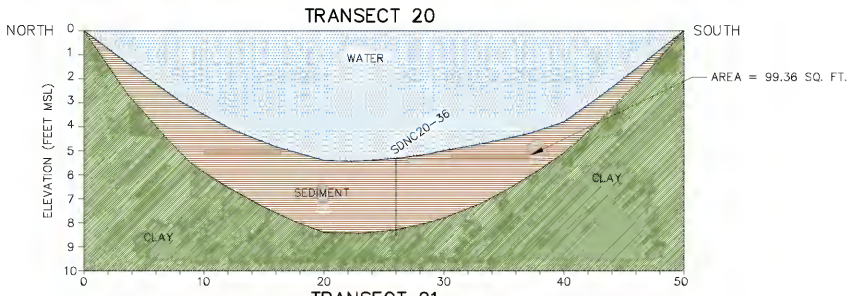
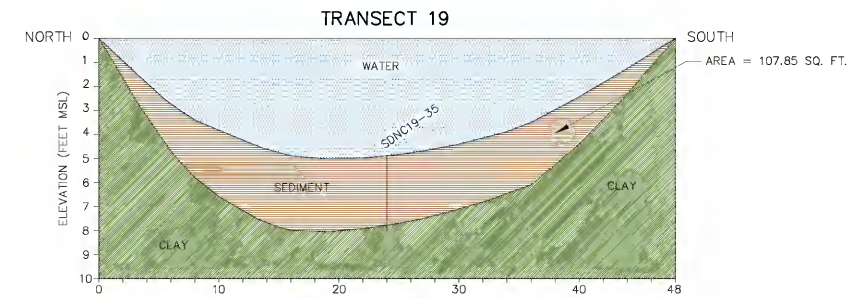
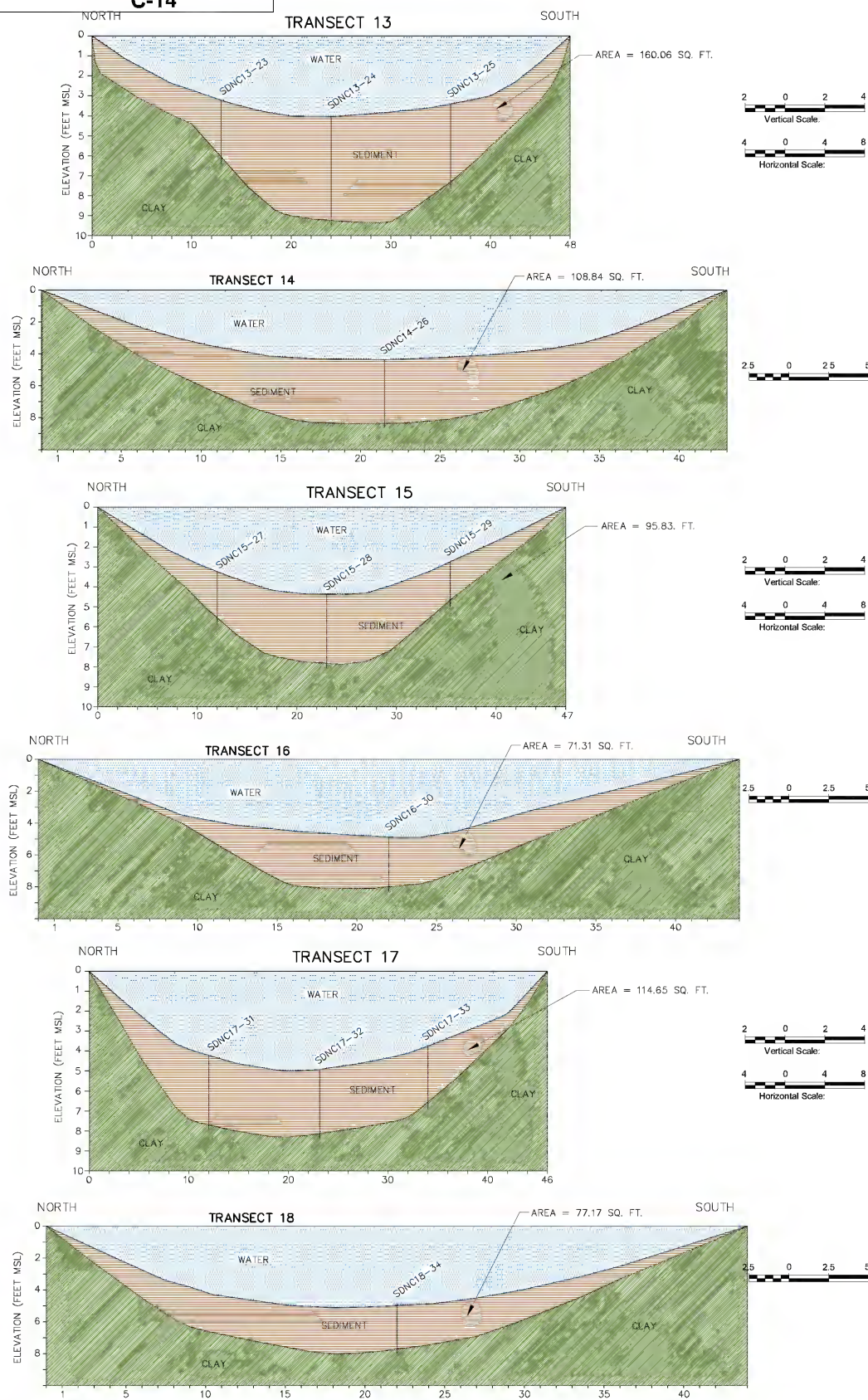
Tt TETRA TECH EC, INC.

SCALE: AS SHOWN	APPROVED	DATE: 12-15-05 (C)
DIVISION: SANTA ANA	MDC	C-13
DRAWN: MD	AE	
CHECKED: HH		

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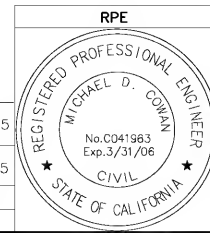
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C-14



THIS DRAWING
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DO NOT REVISE MANUALLY

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B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
TRANSECT CROSS SECTIONS
13 THROUGH 25**

TN & A Engineering and Science

TETRA TECH

SCALE: AS SHOWN

DIVISION: SANTA ANA

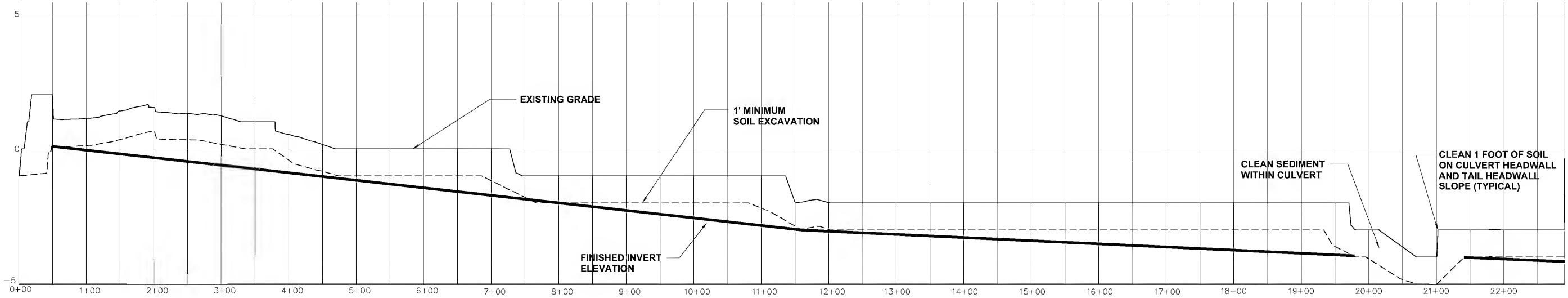
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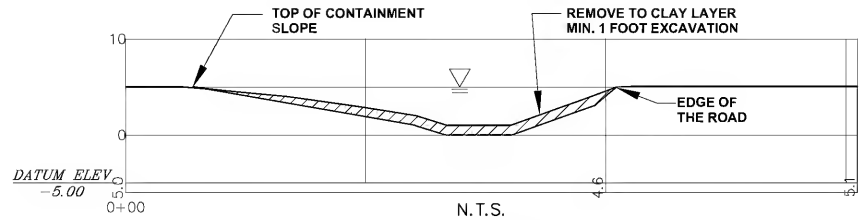
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C-14

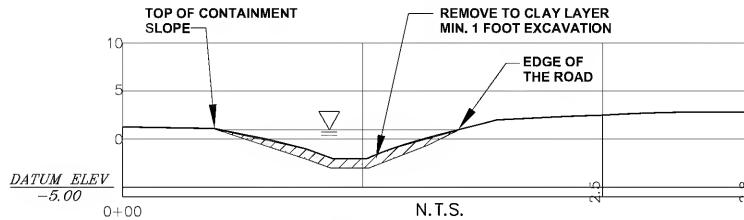
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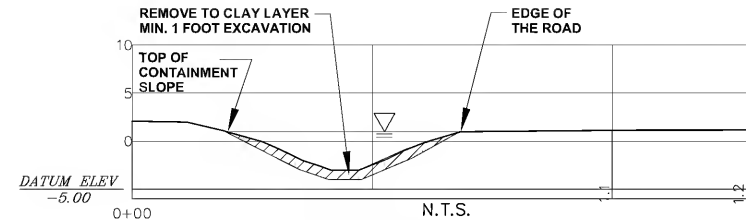
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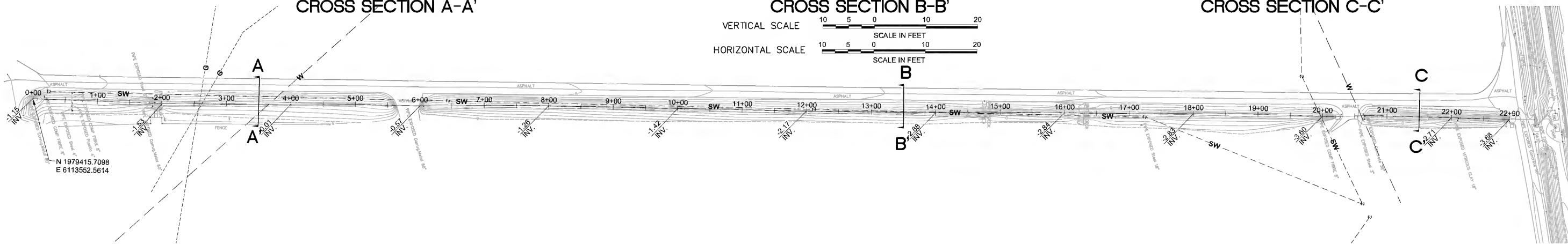
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CROSS SECTION B-B'

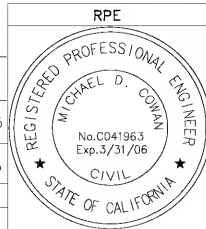


CROSS SECTION C-C'



MARRIAGE ROAD PLAN AND PROFILE

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A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
MARRIAGE ROAD PLAN AND PROFILE
STATION 0+00.00 TO 22+90.00

TN & A T N & Associates, Inc.
Engineering and Science

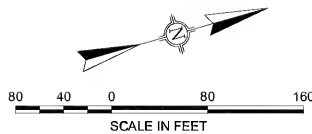
TE TETRA TECH EC, INC.

SCALE: AS SHOWN	APPROVED MDC	DATE: 12-15-05 (C)
DIVISION: SANTA ANA	AE	
DRAWN: MD		
CHECKED: HH		

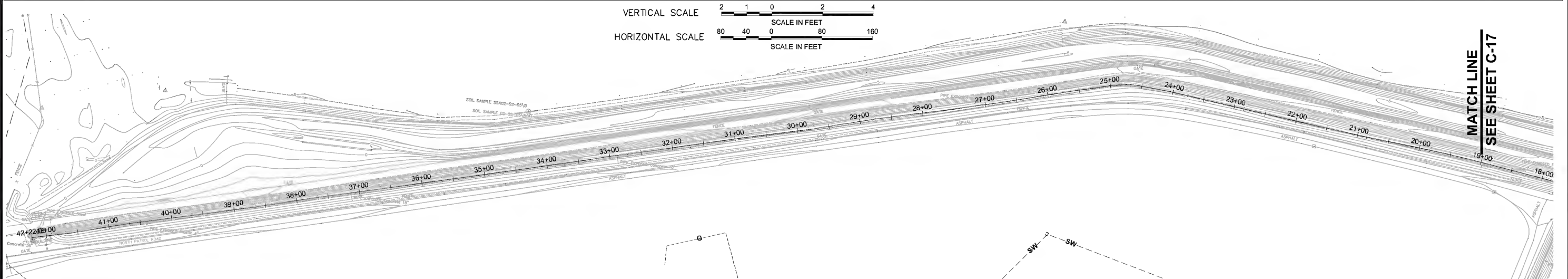
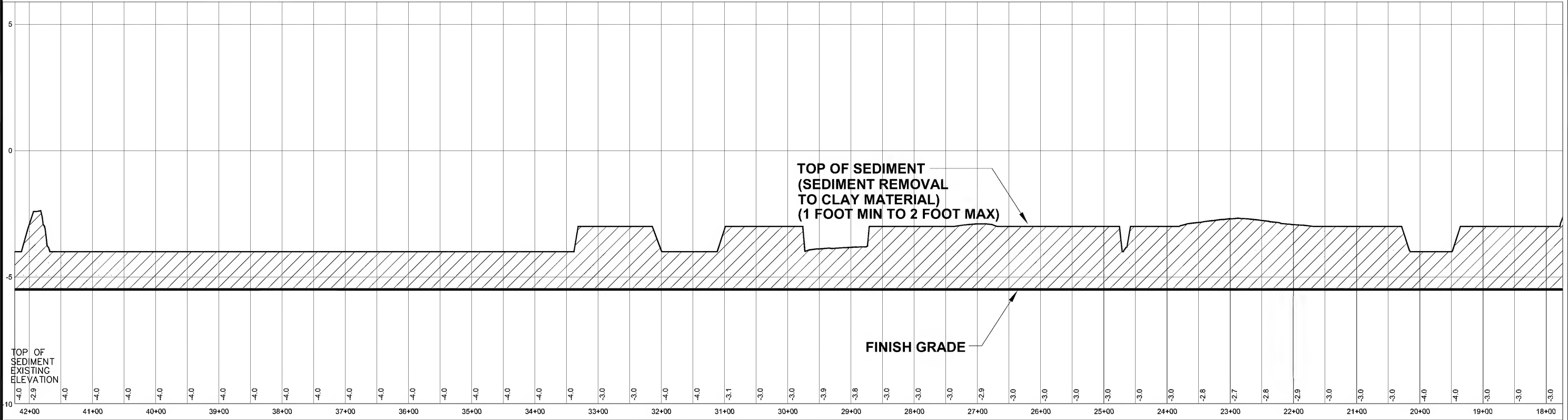
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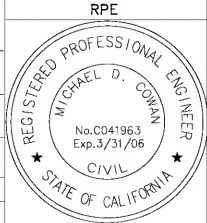
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NORTH PATROL ROAD PLAN AND PROFILE

1. FOR CROSS SECTION SEE C-18 NORTHERN CHANNEL CROSS SECTION CS 9+25/TRANSECT2
2. FOR CROSS SECTION SEE C-18 NORTHERN CHANNEL CROSS SECTION CS 18+25/TRANSECT3

C	DRAFT FINAL REMEDIAL DESIGN	MDC	MD	HH	MDC	12/15/05
B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
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REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE

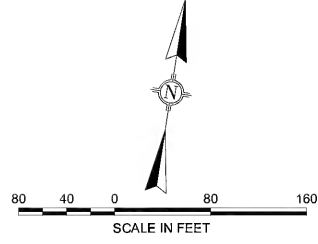


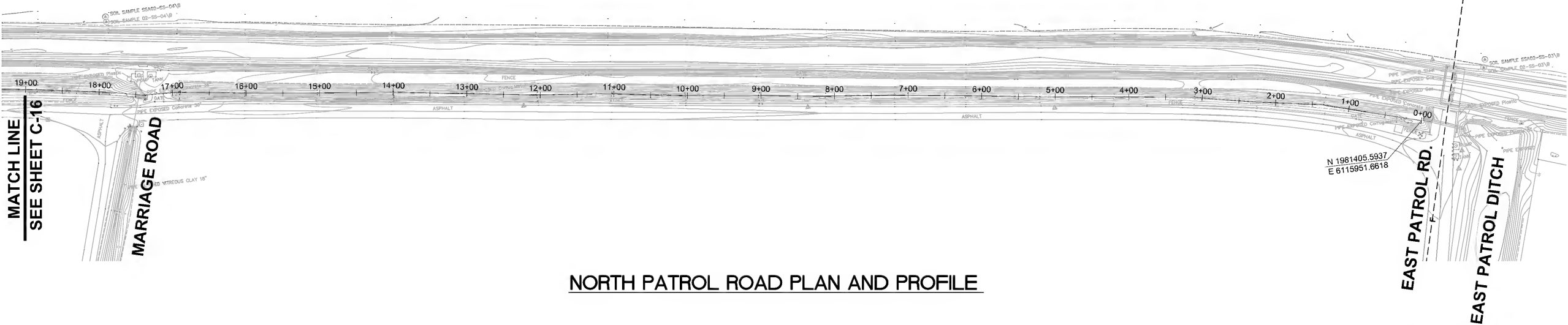
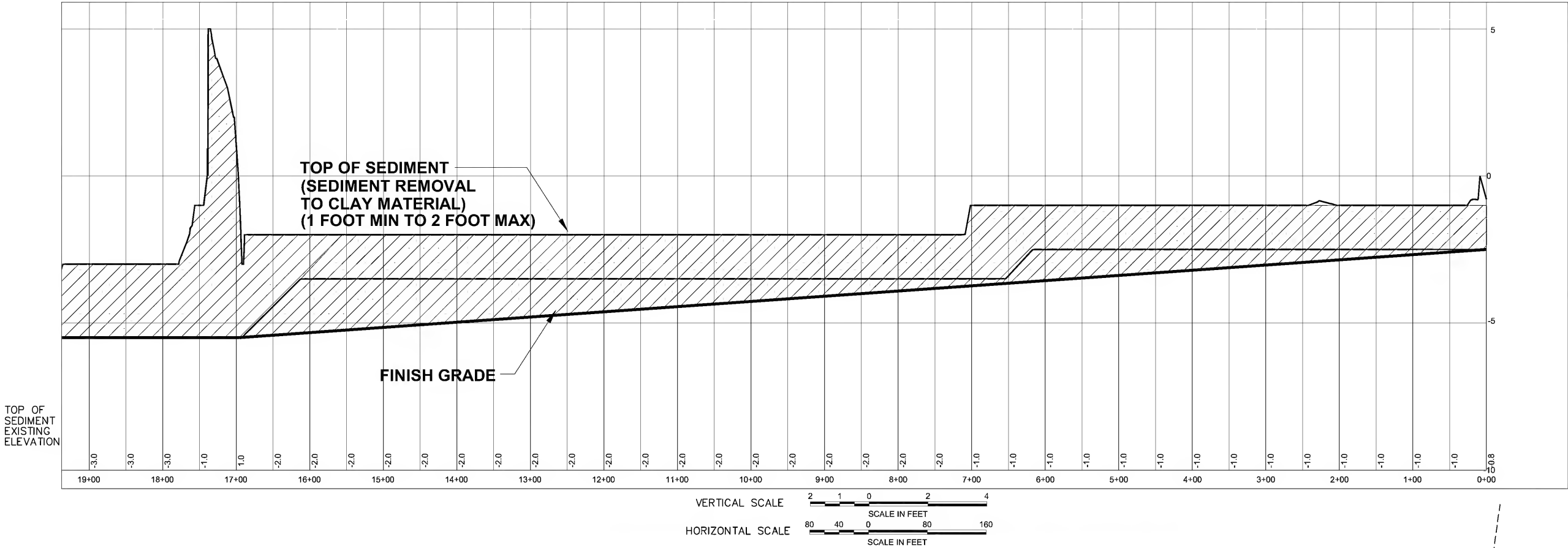
**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
NORTH PATROL ROAD PLAN AND PROFILE
STATION 42+22.00 TO 19+00.00**

T N & Associates, Inc.
Engineering and Science

Tc **TETRA TECH EC, INC.**

SCALE: AS SHOWN	APPROVED MDC	DATE: 12-15-05 (C)
DIVISION: SANTA ANA	AE	
DRAWN: MD		
CHECKED: HH		

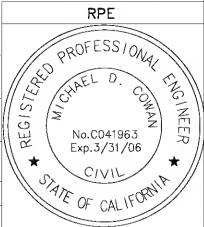




NORTH PATROL ROAD PLAN AND PROFILE

1. FOR CROSS SECTION SEE C-18 NORTHERN CHANNEL CROSS SECTION CS 28+25/TRANSECT4
2. FOR CROSS SECTION SEE C-19 NORTHERN CHANNEL CROSS SECTION CS 39+00/TRANSECTS

C	DRAFT FINAL REMEDIAL DESIGN	MDC	MD	HH	MDC	12/15/05
B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						

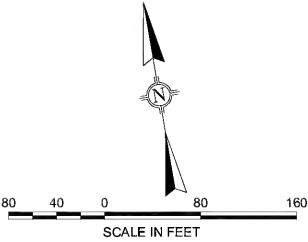


**FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
NORTH PATROL ROAD PLAN AND PROFILE
STATION 19+00.00 TO 0+00.00**

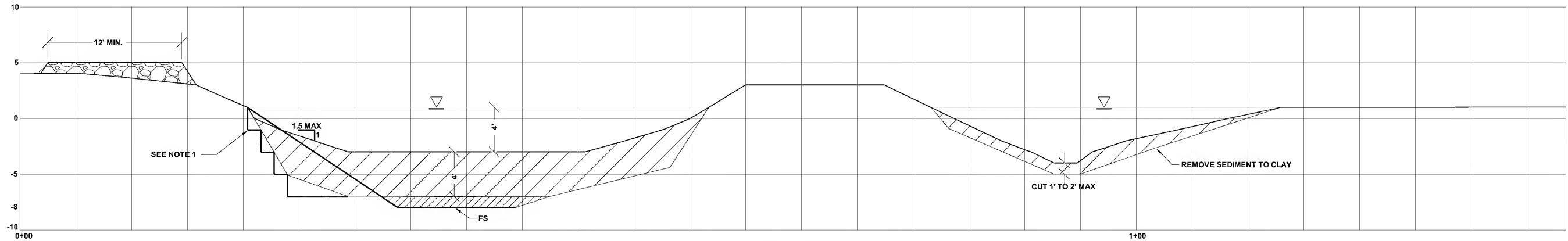
TN & Associates, Inc.
Engineering and Science

Tc **TETRA TECH EC, INC.**

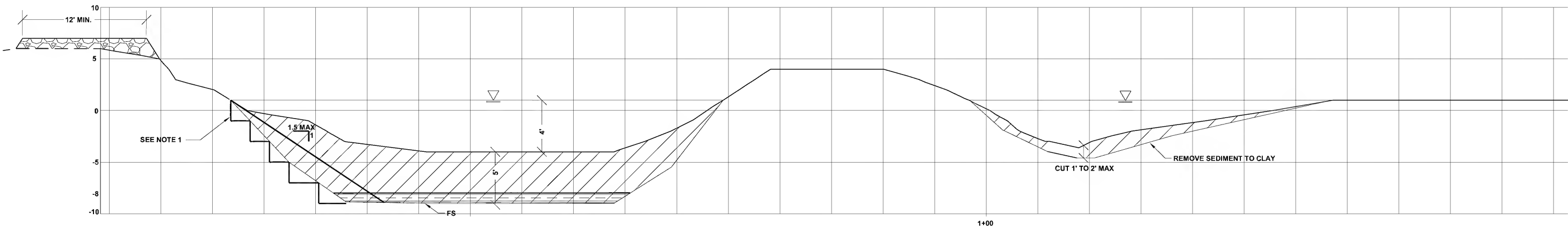
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DIVISION: SANTA ANA	AE	
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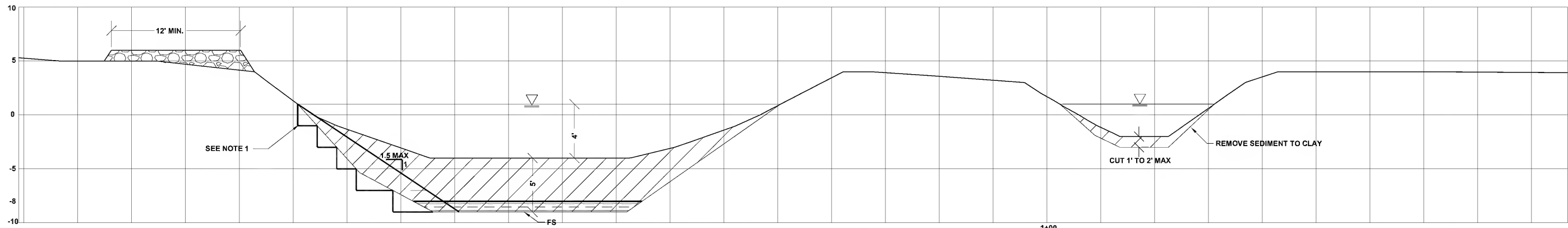
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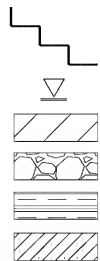
CS 9+25/TRANSECT 2



CS 18+25/TRANSECT 3



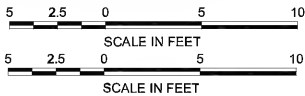
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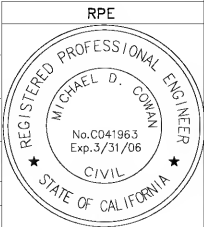
BENCH COMPACTION
HIGH WATER LEVEL
SEDIMENT REMOVAL
GRAVEL BASE
CLAY FILL MATERIAL
OVER EXCAVATION OF
CLAY BASE MATERIAL

NOTE 1
FILL CHANNEL SLOPE AT A
MAX 1.5:1 WITH SELECT FILL
MATERIAL. COMPACT TO 90%
WITH 2' BENCHES TO FINISH GRADE.

VERTICAL SCALE
HORIZONTAL SCALE



C	DRAFT FINAL REMEDIAL DESIGN	MDC	MD	HH	MDC	12/15/05
B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
NORTHERN CHANNEL
CROSS SECTION - TRANSECT SECTIONS 2,3 AND 4

TN & A **T N & Associates, Inc.**
Engineering and Science

Tt **TETRA TECH EC, INC.**

SCALE: AS SHOWN

APPROVED
MDC
AE

DATE: 12-15-05 (C)

DIVISION: SANTA ANA

DRAWN: MD

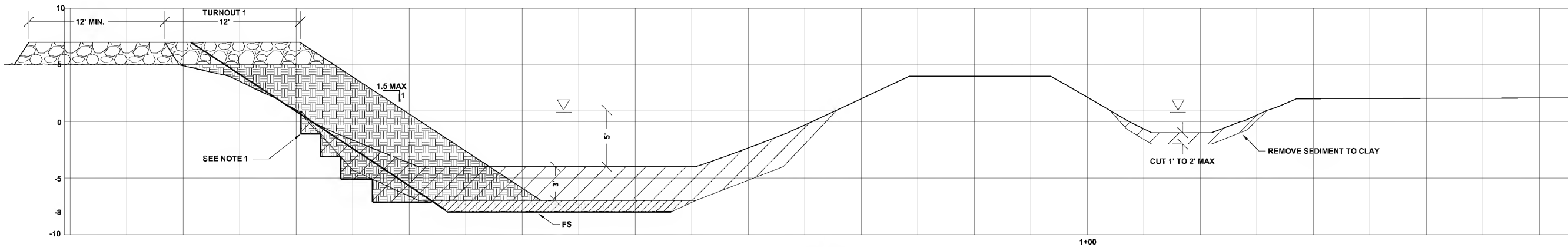
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C-18

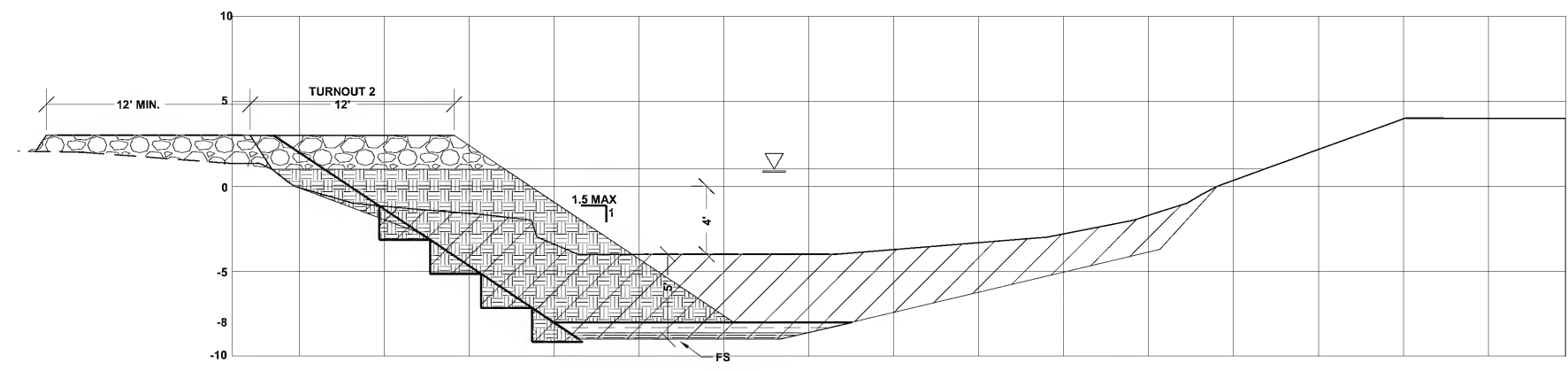
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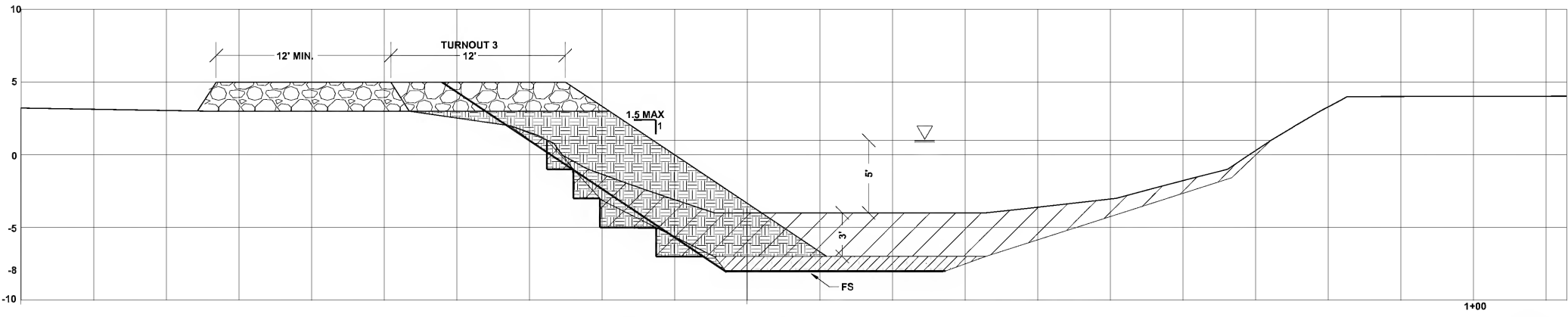
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DO NOT REVISE MANUALLY



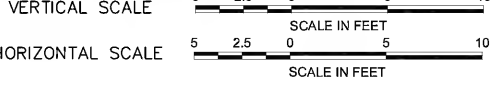
CS 39+00/TRANSECT 5



CS 66+25/TRANSECT 13



CS 84+30/TRANSECT 20



- NOTES:
1. FILL CHANNEL SLOPE AT A MAX 1.5:1 WITH SELECT FILL MATERIAL. COMPACT TO 90% WITH 2' BENCHES.
 2. REMOVE TURNOUT SELECTED MATERIAL AT THE END OF PROJECT TO FINISH GRADE (FG).

C	DRAFT FINAL REMEDIAL DESIGN	MDC	MD	HH	MDC	12/15/05
B	DRAFT DESIGN	MDC	MD	HH	MDC	09/02/05
A	PRE-DRAFT DESIGN	MDC	MD	HH	MDC	07/15/05
REV	REVISION DESCRIPTION	DESIGNED	PREPARED	CHECKED	APPROVED	DATE
REVISION APPROVAL						



FORMER NAS MOFFETT FIELD
SITE 27 DRAFT FINAL REMEDIAL DESIGN
NORTHERN CHANNEL
CROSS SECTION - TRANSECT SECTIONS 5, 13 AND 20

TN & A T N & Associates, Inc.
Engineering and Science

Tt TETRA TECH EC, INC.

SCALE: AS SHOWN	APPROVED	DATE: 12-15-05 (C)
DIVISION: SANTA ANA	MDC	C-19
DRAWN: MD	AE	
CHECKED: HH		

C

APPENDIX J

SPECIFICATIONS

APPENDIX J
DRAFT FINAL
SPECIFICATIONS

FOR

SITE 27
FORMER NAVAL AIR STATION MOFFETT FIELD,
SANTA CLARA COUNTY, CALIFORNIA

ENVIRONMENTAL MULTIPLE AWARD CONTRACT
Contract Number N68711-04-D-1105
Contract Task Order 0002

January 13, 2006

Prepared for



Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Prepared by

TN
&A **T N & Associates, Inc.**
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317 East Main Street
Ventura, California 93001

Tt **TETRA TECH EC, INC.**
1940 East Deere Avenue, Suite 200
Santa Ana, California 92705

APPENDIX J
SPECIFICATIONS

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Section 01500	Temporary Facilities and Controls
Section 01575	Temporary Environmental Controls
Section 01720	Surveying
Section 02231	Clearing and Grubbing
Section 02300	Earthwork
Section 02620	Subdrainage System
Section 02661	Geosynthetic Products (Geomembrane, Geotextile, Geonet)
Section 02930	Vegetation

SECTION 01110 SUMMARY OF WORK

PART 1 GENERAL

1.1 PROJECT DESCRIPTION

The work includes excavation of the contaminated sediments from the Northern Channel and drainage ditches, and contaminated soil from the berm and the debris pile where chemical levels are higher than the cleanup goals. The approximate total volume of sediments and soil to be excavated is approximately 65,000 cubic yards, which will be disposed off site at a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-approved landfill. The work also includes clearing and grubbing; installation of erosion control measures, geomembranes, geofabric and geonet placement; grading; stockpiling and dewatering of contaminated soil and sediments; and site restoration. The excavated sediment shall be dried prior to off-site disposal to meet the off-site disposal facility's criteria. This may be accomplished by a combination of proper materials handling and reagent additives (e.g., waste lock polymer materials).

The work is being performed under the removal action authority delineated at 40 Code of Federal Regulations (CFR) Part 300, and promulgated under the CERCLA. The Navy's Contracting Officer and designer shall oversee construction activities.

1.1.1 LOCATION

The limits of work shall be located at Site 27 – North Area, former Naval Air Station Moffett Field (Moffett), Moffett, California, as shown on Drawing C-2.

1.2 SITE CONTAMINANTS

Previous investigations have revealed chemicals including polychlorinated biphenyls (PCBs), pesticides, and metals in sediment samples from the Northern Channel at levels that require cleanup. The highest concentrations of chemicals were generally beneath the top 3 inches of sediment. In the deeper clay layer, the levels of chemicals were much lower and did not exceed cleanup levels. The chemical levels found in surface water samples for the site were generally acceptable. PCBs were detected above cleanup levels in the upper sediment layers and soil of the Marriage Road Ditch and in the North Patrol Road Ditch. Concentrations of PCBs in the deeper clay layer samples from these areas were below the cleanup levels for total PCBs. Pesticides and metals were detected above the cleanup levels in the Marriage Road Ditch, but generally below cleanup levels in the other two ditches. In addition, PCBs, pesticides, and metals were detected at concentrations above cleanup levels at the western end of the Northern Channel berm and debris pile area.

1.3 List of Contact Personnel

Agency	Contact	Project Title
Base Realignment and Closure Program Management Office West 1455 Frazee Road, Suite 900 San Diego, CA 92108-4310	Scott Gromko (619) 532-0933	Remedial Project Manager
IPT West ROICC P. O. Box 68, Building 107 Moffett Field, CA 94035	Gary Munekawa, P.E. (650) 603-9834	Project Engineer and Navy Technical Representative/ROICC
IPT West ROICC P. O. Box 68, Building 107 Moffett Field, CA 94035	Mr. David R. Smith (650) 603-9836	Construction Manager Technician and Navy Technical Representative/ROICC
Base Realignment and Closure Program Management Office West 1455 Frazee Road, Suite 900 San Diego, CA 92108-4310	Rick Weissenborn, P.E. (619) 532-0952	Lead Remedial Project Manager
Naval Facilities Engineering Command, Southwest 1220 Pacific Highway San Diego, CA 92132-5190	Mr. Narciso Ancog (619) 532-2540	Quality Assurance Officer
EPA Region 9 75 Hawthorne St., SDF-73 San Francisco, CA 94105	Ms. Alana Lee (415) 972 3141	EPA – Remedial Project Manager
WB, San Francisco Bay Region 1515 Clay Street, Suite 1400 Oakland, CA 94612	Adriana Constantinescu, P.G. (510) 622-2353	WB – Remedial Project Manager

Abbreviations and Acronyms:

IPT West – Integrated Product Team-West
EPA – U.S. Environmental Protection Agency
P.E. – Professional Engineer
P.G. – Professional Geologist
ROICC – Resident Officer in Charge of Construction
WB – California Water Board

1.4 SUBMITTALS

Submit the following in accordance with Section 01330, Submittal Procedures:

1.4.1 SD-01, Pre-construction Submittal

- a. List of contact personnel; G

1.5 CONTRACTOR PERSONNEL REQUIREMENTS

1.5.1 Contractors and Personnel

Furnish a list of contact personnel of the Contractor, including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.5.2 Contact Personnel List

Submit for approval, at least 15 days in advance of the desired date of entry, an original alphabetical list of personnel who require entry into government property to perform work on the project. Furnish for each person:

- a. Name
- b. Date and place of birth
- c. Citizenship
- d. Home address

The request for personnel passes shall be accompanied with the following certification:

"I hereby certify that all personnel on this list are either born U.S. citizens or naturalized U.S. citizens with the naturalization number shown."

1.5.3 Identification Badges

Identification badges will be furnished without charge. Application for and use of badges will be as directed. Immediately report lost or stolen badges to the Contracting Officer. All badges must be returned at the completion of the project.

1.6 CONTRACTOR ACCESS AND USE OF PREMISES

1.6.1 Base Regulations

Ensure that Contractor personnel employed on the base become familiar with and obey base regulations. Keep within the limits of the work and avenues of ingress and egress. Do not enter restricted areas, unless required to do so and until cleared for entry. Permission to interrupt any station roads or utility services shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption. The Contractor's equipment shall be conspicuously marked for identification.

1.6.2 Working Hours

Regular working hours shall be 7:00 a.m. to 4:30 p.m. Monday through Friday, excluding government holidays.

1.6.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Provide written request 7 calendar days prior to such work to allow arrangements to be made by the Navy for inspecting the work in progress. During periods of darkness, work shall be lighted in a manner approved by the Contracting Officer.

1.6.4 Unauthorized Access

Ensure that the public and other unauthorized personnel do not have access to the area during the construction period.

1.7 UNDERGROUND FACILITIES

The locations of existing underground utilities shall be verified by the Contractor, prior to the start of field activities. Utility maps and as-built drawing can be obtained from the ROICC's office. Contractor shall verify the locations of the utilities shown and any other utilities that may be present. Scan the construction site with electromagnetic or sonic equipment, and mark the surface of the ground where existing underground utilities are discovered. Verify the location and elevation of existing piping, utilities, and other types of underground obstructions not indicated but discovered during scanning. Protect all utilities encountered during construction.

1.8 SCHEDULE

Contractor shall schedule construction activity, in addition to other stated requirements, within the constraints and fulfilling the requirements of the contract; Section 02300, Earthwork; and Section 01575, Temporary Environmental Controls. Allowable seeding and vegetation establishment periods may affect the overall project schedule.

1.9 DELAYS

Notify the Contracting Officer of delays or changes in construction schedule within 48 hours. Cessation of construction activities resulting from delays shall not constitute the release of Contractor's responsibility to maintain a tidy, secured, and protected site. In such case, Contractor shall protect all surfaces from erosion and all materials from degradation. When construction activities resume, Contractor shall return grades and installed items to their condition before construction ceased.

1.10 ESTIMATION OF EARTHWORK

Topographical and survey information on Appendix E of the Remedial Design Report must be field verified. Accurate cut and fill volume must be determined by Contractor after clearing and grubbing and surface debris removal has been performed.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

**SECTION 01310
ADMINISTRATIVE REQUIREMENTS**

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01330, Submittal Procedures.

1.1.1 SD-01, Pre-construction Submittal

a. List of contact personnel

1.1.2 Asbestos-containing Material

The contractor will be responsible for proper abatement of asbestos-containing material.

1.2.3 Contractor Personnel Requirements

Failure to obtain entry approval will not affect the contract price or time of completion.

1.2 SUPERVISION

Have at least one qualified supervisor capable of reading, writing, and conversing fluently in the English language on the jobsite during working hours. In addition, if a quality control (QC) representative is required on the contract, then that individual shall also have fluent English communication skills.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

**SECTION 01320
CONSTRUCTION PROGRESS DOCUMENTATION**

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01330, Submittal Procedures:

1.1.1 SD-01, Pre-construction Submittals

- a. Construction schedule

1.2 CONSTRUCTION SCHEDULE

A proposed construction schedule will be submitted to the Contracting Officer by the Contractor with the Work Plan.

1.3 NETWORK ANALYSIS SYSTEM (NAS)

The Contractor shall use the critical path method (CPM) to schedule and control construction activities. The schedule shall identify at a minimum:

- Construction time for all major systems and components
- Manpower requirements for each activity
- Major submittals and submittal processing time

1.3.1 CPM Submittals and Procedures

Submit all network analysis and updates in hard copy. The network analysis system shall be kept current, with changes made to reflect the actual progress and status of construction.

1.5 UPDATED SCHEDULES

Update the construction schedule and equipment delivery schedule at monthly intervals or when the schedule has been revised. Reflect any changes that occurred since the last update. Submit copies of the purchase orders and confirmation of the delivery dates as directed.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

SECTION 01330
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal

Shop drawings, product data, samples, operation and maintenance data, and administrative submittals presented for review and approval. Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

1.1.2 Types of Submittals

All submittals are classified as indicated in paragraph "Submittal Descriptions (SD)". Submittals also are grouped as follows:

- a. Shop drawings: As used in this section, drawings, schedules, diagrams, and other data prepared specifically for this contract, by contractor or through contractor by way of manufacturer, supplier, distributor, or other lower tier contractor, to illustrate portion of work.
- b. Product data: Preprinted material such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other data to illustrate portion of work, but not prepared exclusively for this contract.
- c. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to portion of work, illustrating portion of work or establishing standards for evaluating appearance of finished work or both.
- d. Administrative submittals: Data presented for reviews and approval to ensure that administrative requirements of project are adequately met but not to ensure directly that work is in accordance with design concept and in compliance with contract documents.
- e. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the government. The following shall be submitted in accordance with Section 01330, Submittal Procedures.

1.2 SUBMITTAL IDENTIFICATION (SD)

Submittals required are identified by SD numbers and titles as follows:

SD-01 Pre-construction Submittals

Certificates of insurance
Surety bonds
List of proposed products
Construction progress schedule
Submittal register
Schedule of values
Health and Safety Plan
Remediation Work Plan
Quality Control Plan
Environmental Protection Plan
Traffic Control Plan
Materials Handling Plan
Cofferdam Installation, Removal and Relocation Plan
Construction Zone and Site Dewatering Plan
Product data

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards by which the ensuring work can be judged. Includes

assemblies or portions of assemblies which are to be incorporated into the project and those which will be removed at conclusion of the work.

SD-05 Design Data

Calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. (Testing must have been within 3 years of date of contract award for the project.)

Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work or prototype prepared for the project before shipment to jobsite.

Report which includes finding of a test made at the jobsite or on sample taken from the jobsite, on portion of work during or after installation.

Investigation reports

Daily checklists

Final acceptance test and operational test procedure

SD-07 Certificates

Statements signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a supplier or installer through Contractor, the purpose of which is to further quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods or personnel qualifications.

Confined space entry permits.

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

SD-09 Manufacturer's Field Reports

Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

Factory test reports.

SD-10 Operation and Maintenance Data

Data that is furnished by the manufacturer, or the system provider, to the equipment operating and maintenance personnel. This data is needed by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

1.2.1 Approving Authority

Person authorized to approve submittal.

1.2.2 Work

As used in this section, on- and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.3 SUBMITTALS

Submit the following in accordance with the requirements of this section.

1.3.1 SD-01, Pre-construction Submittal

Submittal Register; G

1.3.2 SD-11, Closeout Submittals

Submittal Register; G
As-built drawings; G
Special warranties; G
Posted operating instructions; G
As-built field summary report; G

1.4 USE OF SUBMITTAL REGISTER

Prepare and maintain submittal register, as the work progresses. Do not change data which is output in columns (c), (d), (e), and (f) as delivered by government; retain data which is output in columns (a), (g), (h), and (i) as approved. An example of a [submittal register](#) to be provided by Contractor is attached.

1.4.1 Submittal Register

Submit Submittal Register with QC Plan and project schedule required by Section 01450, Quality Control. Do not change data in columns (c), (d), (e), and (f) as delivered by the government. Verify that all submittals required for project are listed and add missing submittals. Complete the following on the register:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for approving authority to receive submittals.

Column (h) Contractor Approval Date: Date Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.4.2 Contractor Use of Submittal Register

Update the following fields in the government-furnished submittal register program or equivalent fields in program utilized by Contractor.

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to QC.

Column (l) List date of submittal transmission.

Column (q) List date approval received.

1.4.3 Approving Authority Use of Submittal Register

Update the following fields.

Column (b).

Column (l) List date of submittal receipt.

Column (m) through (p).

Column (q) List date returned to Contractor.

1.4.4 Contractor Action Code and Action Code

Entries used will be as follows (others may be prescribed by Transmittal Form):

NR - Not received

AN - Approved as noted

A - Approved

RR - Disapproved, revise, and resubmit

1.4.5 Copies Delivered to the Government

Deliver one copy of Submittal Register updated by Contractor to government with each invoice request.

1.5 PROCEDURES FOR SUBMITTALS

1.5.1 Reviewing, Certifying, Approving Authority

QC organization shall be responsible for reviewing and certifying that submittals are in compliance with contract requirements. Approving authority on submittals is the QC Manager, unless otherwise specified for specific submittal. At each "Submittal" paragraph in individual specification sections, a notation "G," following a submittal item, indicates contracting officer is approving authority for that submittal item.

1.5.2 Constraints

- a. Submittals listed or specified in this contract shall conform to provisions of this section, unless explicitly stated otherwise.
- b. Submittals shall be complete for each definable feature of work; components of definable feature interrelated as a system shall be submitted at same time.
- c. When acceptability of a submittal is dependent on conditions, items, or materials included in separate subsequent submittals, submittal will be returned without review.
- d. Approval of a separate material, product, or component does not imply approval of assembly in which item functions.

1.5.3 Scheduling

- a. Coordinate scheduling, sequencing, preparing and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow for potential requirements to resubmit.
- b. Except as specified otherwise, allow review period, beginning with receipt by approving authority, that includes at least 15 working days for submittals for QC Manager approval and 20 working days for submittals for Contracting Officer approval. Period of review for submittals with Contracting Officer approval begins when government receives submittal from QC organization. Period of review for each resubmittal is the same as for initial submittal.

1.5.4 Variations

Variations from contract requirements require government approval pursuant to contract clause entitled "FAR 52.236-21, Specifications and Drawings for Construction" and will be considered where advantageous to government.

1.5.4.1 Considering Variations

Discussion with Contracting Officer prior to submission, will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. When contemplating a variation which results in lower cost, consider submission of the variation as a Value Engineering Change Proposal (VECP).

1.5.4.2 Proposing Variations

When proposing variation, deliver written request to the contracting officer, with documentation of the nature and features of the variation and why the variation is desirable and beneficial to government. If lower cost is a benefit, also include an estimate of the cost saving. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

1.5.4.3 Warranting That Variations Are Compatible

When delivering a variation for approval, Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.5.4.4 Review Schedule Is Modified

In addition to normal submittal review period, a period of 10 working days will be allowed for consideration by the government of submittals with variations.

1.5.5 Contractor's Responsibilities

- a. Determine and verify field measurements, materials, field construction criteria; review each submittal; and check and coordinate each submittal with requirements of the work and contract documents.
- b. Transmit submittals to QC organization in accordance with schedule on approved Submittal Register, and to prevent delays in the work, delays to government, or delays to separate contractors.
- c. Advise Contracting Officer of variation, as required by paragraph entitled "Variations."
- d. Correct and resubmit submittal as directed by approving authority. When resubmitting disapproved transmittals or transmittals noted for resubmittal, the Contractor shall provide copy of that previously submitted transmittal including all reviewer comments for use by approving authority. Direct specific attention in writing or on resubmitted submittal, to revisions not requested by approving authority on previous submissions.
- e. Furnish additional copies of submittal when requested by Contracting Officer, to a limit of 20 copies per submittal.
- f. Complete work which must be accomplished as basis of a submittal in time to allow submittal to occur as scheduled.
- g. Ensure no work has begun until submittals for that work have been returned as "approved," or "approved as noted", except to the extent that a portion of work must be accomplished as basis of submittal.

1.5.6 QC Organization Responsibilities

- a. Note date on which submittal was received from Contractor on each submittal.
- b. Review each submittal; and check and coordinate each submittal with requirements of work and contract documents.
- c. Review submittals for conformance with project design concepts and compliance with contract documents.
- d. Act on submittals, determining appropriate action based on QC organization's review of submittal.

(1) When the QC Manager is approving authority, take appropriate action on submittal from the possible actions defined in paragraph entitled, "Actions Possible."

(2) When the Contracting Officer is approving authority or when variation has been proposed, forward submittal to government with certifying statement or return submittal marked "not reviewed" or "revise and resubmit" as appropriate. The QC organization's review of submittal determines appropriate action.

- e. Ensure that material is clearly legible.
- f. Stamp each sheet of each submittal with QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When approving authority is contracting officer, QC organization will certify submittals forwarded to Contracting Officer with the following certifying statement:

"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with contract Number N68711-04-D-1105, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is submitted for government approval.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Certified by QC Manager _____, Date _____"
(Signature)

(2) When approving authority is the QC Manager, the QC Manager will use the following approval statement when returning submittals to contractor as "Approved" or "Approved as Noted."

"I hereby certify that the (material) (equipment) (article) shown and marked in this submittal and proposed to be incorporated with contract Number N68711-98-D-5713, is in compliance with the contract drawings and specification, can be installed in the allocated spaces, and is _____ approved for use.

Certified by Submittal Reviewer _____, Date _____
(Signature when applicable)

Approved by QC Manager _____, Date _____"
(Signature)

- g. Sign certifying statement or approval statement. The person signing certifying statements shall be QC organization member designated in the approved QC Plan. The signatures shall be in original ink. Stamped signatures are not acceptable.
- h. Update submittal register as submittal actions occur and maintain the submittal register at project site until final acceptance of all work by Contracting Officer.
- i. Retain a copy of approved submittals at project site, including Contractor's copy of approved samples.

1.5.7 Government's Responsibilities

When approving authority is the Contracting Officer, the government will:

- a. Note date on which submittal was received from the QC Manager, on each submittal for which the contracting officer is approving authority.
- b. Review submittals for approval within scheduling period specified and only for conformance with project design concepts and compliance with contract documents.
- c. Identify returned submittals with one of the actions defined in paragraph entitled "Actions Possible" and with markings appropriate for action indicated.

1.5.8 Actions Possible

Submittals will be returned with one of the following notations:

- a. Submittals marked "not reviewed" will indicate that submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.
- b. Submittals marked "approved" "approved as submitted" authorize Contractor to proceed with work covered.
- c. Submittals marked "approved as noted" or "approval except as noted; resubmission not required" authorize Contractor to proceed with work as noted provided Contractor takes no exception to the notations.
- d. Submittals marked "revise and resubmit" or "disapproved" indicate submittal is incomplete or does not comply with design concept or requirements of the contract documents and shall be resubmitted

with appropriate changes. No work shall proceed for this item until resubmittal is approved.

1.6 FORMAT OF SUBMITTALS

1.6.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to office of approving authority. Transmit submittals with transmittal form prescribed by Contracting Officer and standard for project. The transmittal form shall identify Contractor, indicate date of submittal, and include information prescribed by transmittal form and required in paragraph entitled "Identifying Submittals." Process transmittal forms to record actions regarding sample panels and sample installations.

1.6.2 Identifying Submittals

Identify submittals, except sample panel and sample installation, with the following information permanently adhered to or noted on each separate component of each submittal and noted on transmittal form. Mark each copy of each submittal identically, with the following:

- a. Project title and location.
- b. Construction contract number.
- c. Section number of the specification section by which submittal is required.
- d. SD number of each component of submittal.
- e. When a resubmission, add alphabetic suffix on submittal description, for example, SD-10A, to indicate resubmission.
- f. Name, address, and telephone number of supplier, manufacturer and any other second tier Contractor associated with submittal.
- g. Product identification and location in project.

1.6.3 Format for Shop Drawings

- a. Shop drawings shall not be less than 8 1/2 by 11 inches nor more than 30 by 42 inches.
- b. Present 8 1/2 by 11 inches sized shop drawings as part of the bound volume for submittals required by section. Present larger drawings in sets.
- c. Include on each drawing the drawing title, number, date, and revision numbers and dates, in addition to information required in paragraph entitled "Identifying Submittals."
- d. Dimension drawings, except diagrams and schematic drawings; prepare drawings demonstrating interface with other trades to scale. Shop drawing dimensions shall be the same unit of measure as indicated on the contract drawings. Identify materials and products for work shown.

1.6.4 Format of Product Data

- a. Present product data submittals for each section as a complete, bound volume. Include table of contents, listing page and catalog item numbers for product data.
- b. Indicate, by prominent notation, each product which is being submitted; indicate specification section number and paragraph number to which it pertains.
- c. Supplement product data with material prepared for project to satisfy submittal requirements for which product data does not exist. Identify this material as developed specifically for project.

1.6.5 Format of Samples

- a. Furnish samples in sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately same size as specified:
 - (1) Sample of equipment or device: full size.
 - (2) Sample of materials less than 2 by 3 inches: built up to 8 1/2 by 11 inches.
 - (3) Sample of materials exceeding 8 1/2 by 11 inches: cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.
 - (4) Sample of linear devices or materials: 10-inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.
 - (5) Sample of non-solid materials: pint. Examples of non-solid materials are sand and paint.
 - (6) Color selection samples: 2 by 4 inches.
 - (7) Sample panel: 4 by 4 feet.
 - (8) Sample installation: 100 square feet.
- B. Samples showing range of variation: where variations are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range.
- C. Reusable samples: incorporate returned samples into work only if so specified or indicated. Incorporated samples shall be in undamaged condition at time of use.
- D. Recording of sample installation: note and preserve the notation of area constituting sample installation but remove notation at final cleanup of project.

- e. When color, texture or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.6.7 Format of Administrative Submittals

- a. When submittal includes a document which is to be used in project or become part of project record, other than as a submittal, do not apply Contractor's approval stamp to document, but to a separate sheet accompanying document.

1.7 QUANTITY OF SUBMITTALS

1.7.1 Number of Copies of Shop Drawings

- a. Submit six copies of submittals of shop drawings requiring review and approval only by QC organization and seven copies of shop drawings requiring review and approval by Contracting Officer.

1.7.2 Number of Copies of Product Data

Submit product data in compliance with quantity requirements specified for shop drawings.

1.7.3 Number of Samples

- a. Submit two samples, or two sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by approving authority and one will be returned to Contractor.
- b. Submit one sample panel. Include components listed in technical section or as directed.
- c. Submit one sample installation, where directed.
- d. Submit one sample of non-solid materials.

1.7.4 Number of Copies of Administrative Submittals

- a. Unless otherwise specified, submit administrative submittals compliance with quantity requirements specified for shop drawings.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

EXAMPLE

TABLE B.4-1

SUBMITTAL REGISTER

TITLE AND LOCATION: Site 27 Remedial Design and Implementation Former Naval Air Station Moffett Field, Moffett Field, CA				CONTRACTOR Tetra Tech EC, Inc.				CONTRACT NO. N68711-98-D-5713, CTO 0098							
A C T I V I T Y	I R A N S M I T T A L	S P E C I F I C A T I O N	P A R A G R A P H	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/DATE RCD FROM CONTR	APPROVING AUTHORITY			REMARKS		
				C N L A G S O S V I T F I O C R R A E T A V I / W O E R	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N		C O D E	DATE OF ACTION	D A T E O F A C T I O N		C O D E	DATE OF ACTION
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(k)	(l)	(m)	(n)	(o)	(p)	(r)
	01110	SD-01, PRE-CONSTRUCTION SUBMITTAL		1.4.1											
		a. List of Contact Personnel			G										
	01310	SD-01, PRE-CONSTRUCTION SUBMITTAL		1.1.1											
		a. List of Contact Personnel			G										
	01320	SD-01, PRE-CONSTRUCTION SUBMITTALS		1.1.1											
		a. Construction Schedule			G										
		b. Material Delivery Schedule			G										
	01330	SD-01, PRE-CONSTRUCTION SUBMITTAL		1.3.1											
		a. Submittal Register			G										
	01330	SD-11, CLOSEOUT SUBMITTALS		1.3.2											
		a. Submittal Register			G										
		b. As-built drawings			G										
		c. Special warranties			G										
		d. Posted operating instructions			G										
	01450	SD-01, PRE-CONSTRUCTION SUBMITTAL		1.2.1											
		a. Quality Control (QC) Plan			G										
	01500	SD-01, PRE-CONSTRUCTION SUBMITTAL		1.2											
		a. Traffic Control Plan			G										
		b. Remedial work plan													
		c. Cofferdam installation removal and relocation plan													
		d. Construction zone and site dewatering plan													
		e. Construction utility plan													
		f. Product data													
		Construction site plan		1.3											
01500	SD-07, CERTIFICATION		1.12.1												
	a. Cofferdam			G											

EXAMPLE

TABLE B.4-1

SUBMITTAL REGISTER

TITLE AND LOCATION: Site 27 Remedial Design and Implementation Former Naval Air Station Moffett Field, Moffett Field, CA				CONTRACTOR Tetra Tech EC, Inc.				CONTRACT NO. N68711-98-D-5713, CTO 0098									
A C T I V I T Y	I R A N S M I T T A L	S P E C I F I C A T I O N	P A R T S A T A B L E	CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/DATE RCD FROM CONTR	APPROVING AUTHORITY				REMARKS			
				C N L A G S O S V I T A I O C R R A T A V I / W O E R	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N C O D E D A T E O F A C T I O N		DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N C O D E D A T E O F A C T I O N					
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(k)	(l)	(m)	(n)	(o)	(p)	(r)		
		01575	SD-01, PRE-CONSTRUCTION SUBMITTALS	1.4.1													
			a. Site Restoration Plan		G												
			b. Preconstruction Survey Report		G												
			c. Site Health and Safety Plan														
			d. Stormwater Pollution Prevention Plan														
		01575	e. Temporary Power and Utility Plan		G												
			SD-07, CERTIFICATES	1.4.2													
			a. Solid waste disposal manifests		G												
			b. Disposal permit/manifests for hazardous waste		G												
			c. Erosion and Sediment Control Inspection Reports		G												
		01720	SD-01, PRE-CONSTRUCTION SUBMITTAL	1.4													
			a. names and proof of registration														
			b. verification of accuracy (on request)														
			c. certification by surveyor														
			d. Survey drawings														
		02231	e. copy of fiel survey notes														
			SD-01, PRE-CONSTRUCTION SUBMITTAL	1.1.1													
		02300	a. Material product data (MSDS)		G												
			SD-04, SAMPLES	1.2													
			a. Gravel and select embankment fill														
			b. Topsoil material														
			SD-06, TEST REPORTS	1.2													
			a. Import select fill and topsoil material source assessment														
			c. Well mixed gravel														
			d. California Registered Civil Engineer or Geologist certification														
02620	SD-03, CERTIFICATES		1.2.1														
	a. Geotextile fabric																
	b. Pipe for subdrains																

EXAMPLE

TABLE B.4-1

SUBMITTAL REGISTER

TITLE AND LOCATION: Site 27 Remedial Design and Implementation Former Naval Air Station Moffett Field, Moffett Field, CA					CONTRACTOR Tetra Tech EC, Inc.					CONTRACT NO. N68711-98-D-5713, CTO 0098						
A C T I V I T Y	I R A N S M I T T A L	S P E C I F I C A T I O N	P A R T S A V I W O E R	CONTRACTOR SCHEDULE DATES				CONTRACTOR ACTION		DATE FWD TO APPR AUTH/DATE RCD FROM CONTR	APPROVING AUTHORITY				REMARKS	
				C N L A G S O S V I T F I O C R R A E T A V I / W O E R	SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	A C T I O N	C O D E		DATE OF ACTION	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	A C T I O N		C O D E
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(r)
		02661	SD-02, DRAWINGS	1.3												
			SD-03, PRODUCT DATA	1.3												
			SD-05,Manufacturers Installation Instruction	1.3												
			Cofferdam Material and installation information													
			Qualification requirements	1.6												
			Warranty	1.11-b												
		2930	SD-07, CERTIFICATION													
			a. Seed mix													
			b. Soil additives													

**SECTION 01356
STORMWATER MANAGEMENT MEASURES**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 4439	(1997) Standard Terminology for Geosynthetics
ASTM D 4491	(1996) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(1991; R 1996) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(1991; R 1996) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1995) Determining Apparent Opening Size of a Geotextile
ASTM D 4873	(1995) Identification, Storage, and Handling of Geosynthetic Rolls

1.2 GENERAL

The Contractor shall implement the project's construction Stormwater Management Plan (SWMP) in Appendix B of the Remedial Design Report and measures specified in this section in a manner which will meet the requirements of National Aeronautics and Space Administration's (NASA's) National Pollutant Discharge Elimination System (NPDES) permit for the Moffett facility.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the government. The following shall be submitted in accordance with [Section 01330, Submittal Procedures](#).

1.4 EROSION AND SEDIMENT CONTROLS

The controls and measures required by the Contractor are described below.

1.4.1 Stabilization Practices

The stabilization practices to be implemented in accordance with the SWMP, which include geotextiles, erosion control mats, if necessary, preservation

of mature vegetation, revegetation, etc. On the Daily Contractor Quality Control (CQC) Report, the Contractor shall record the dates when the major grading activities occur, (e.g., clearing and grubbing, sediment excavation, embankment work, and finish grading; when construction activities temporarily or permanently cease on a portion of the site; and when stabilization practices are initiated. Except as provided in paragraphs UNSUITABLE CONDITIONS and NO ACTIVITY FOR LESS THAN 21 DAYS during the wet season, stabilization practices shall be initiated as soon as practicable, but no more than 14 days, in any portion of the site where construction activities have temporarily or permanently ceased.

1.4.1.2 No Activity for Less Than 21 Days

Where construction activity will resume on a portion of the site within 21 days from when activities ceased (e.g., the total time period that construction activity is temporarily ceased is less than 21 days), then stabilization practices do not have to be initiated on that portion of the site by the fourteenth day after construction activity temporarily ceased.

1.4.2.1 Silt Fences

The Contractor shall provide silt fences as a temporary measure to minimize erosion and sediment release. Silt fences shall be properly installed to effectively retain sediment immediately after completing each phase of work where erosion and sediment transport would occur in the form of dredging operation, sheet and rill erosion (e.g., clearing and grubbing, excavation, embankment, and grading). Final removal of silt fence barriers shall be performed upon approval by the QC.

1.4.2.3 Turbidity curtains

Floating turbidity curtains in the Northern Channel shall be adequately anchored to prevent failure. The minimum height measured from the top of the flotation to the bottom of the channel shall be 60 inches (assuming 48-inch water elevation). The base width of the curtain shall be weighed. The Contractor shall ensure that the curtains are not damaged by construction operations or traffic before placing. Floating turbidity curtains shall be located downgradient of construction activities and will be relocated as work progresses. An oil absorbing boom "sock" shall be available on site during construction activities to contain any oil release.

PART 2 PRODUCTS

2.1 COMPONENTS FOR SILT FENCES

2.1.1 Filter Fabric

The geotextile shall comply with the requirements of ASTM D 4439, and shall consist of polymeric filaments, which are formed into a stable network such that filaments retain their relative positions. The filament shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of ester, propylene, or amide, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistance to deterioration due to ultraviolet and heat exposure. Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum

of 6 months of expected usable construction life at a temperature range of zero to 120 degrees Fahrenheit. The filter fabric shall meet the following requirements:

FILTER FABRIC FOR SILT SCREEN FENCE

PHYSICAL PROPERTY	TEST PROCEDURE	STRENGTH REQUIREMENT
Grab Tensile Elongation (%)	ASTM D 4632	100 lbs. min. 30 % max.
Trapezoid Tear	ASTM D 4533	55 lbs. min.
Permittivity	ASTM D 4491	0.2 sec-1
AOS (U.S. Std Sieve)	ASTM D 4751	20-100

2.1.2 Silt Fence Stakes and Posts

The Contractor may use either wooden stakes or steel posts for fence construction. Wooden stakes, utilized for silt fence construction, shall have a minimum cross section of 2 inches by 2 inches when oak is used and 4 inches by 4 inches when pine is used, and shall have a minimum length of 5 feet. Steel posts (standard "U" or "T" section) utilized for silt fence construction, shall have a minimum weight of 1.33 pounds per linear foot and a minimum length of 5 feet.

2.1.3 Mill Certificate or Affidavit

A mill certificate or affidavit shall be provided attesting that the fabric and factory seams meet chemical, physical, and manufacturing requirements specified above. The mill certificate or affidavit shall specify the actual Minimum Average Roll Values and shall identify the fabric supplied by roll identification numbers. The Contractor shall submit a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the filter fabric.

2.1.4 Identification Storage and Handling

Filter fabric shall be identified, stored and handled in accordance with ASTM D 4873.

PART 3 EXECUTION

3.1 INSTALLATION OF SILT FENCES

Silt fences used in and along the drainage ditches and along the north berm haul road shall extend a minimum of 16 inches above the ground surface and shall not exceed 34 inches above the ground surface. Filter fabric shall be from a continuous roll cut to the length of the barrier to avoid the use of joints. When joints are unavoidable, filter fabric shall be spliced together at a support post, with a minimum 6-inch overlap, and securely sealed. A trench shall be excavated approximately 4 inches wide and 4 inches deep on the upslope side of the location of the silt fence. The 4-inch by 4-inch

trench shall be backfilled and the soil compacted over the filter fabric. Silt fences shall be removed upon approval by the Contracting Officer.

3.3 MAINTENANCE

The Contractor shall maintain the temporary and permanent vegetation, erosion and sediment control measures, and other protective measures in good and effective operating condition by performing routine inspections to determine condition and effectiveness, by restoration of destroyed vegetative cover, and by repair of erosion and sediment control measures and other protective measures. The following procedures shall be followed to maintain the protective measures.

3.3.1 Silt Fence Maintenance

Silt fences shall be inspected in accordance with paragraph INSPECTIONS. Any required repairs shall be made promptly. Close attention shall be paid to the repair of damaged silt fence resulting from end runs and undercutting. Should the fabric on a silt fence decompose or become ineffective, and the barrier is still necessary, the fabric shall be replaced promptly. Sediment deposits shall be removed when deposits reach one-third of the height of the barrier. When a silt fence is no longer required, it shall be removed. The immediate area occupied by the fence and any sediment deposits shall be shaped to an acceptable grade.

3.3.3 Floating Turbidity Curtains Maintenance

Floating turbidity curtains shall be inspected in accordance with paragraph INSPECTIONS. Close attention shall be paid to the repair of damaged curtain and necessary repairs shall be accomplished promptly. When sediment/oil flotation curtains are no longer required, they shall be removed and stored to an acceptable location on site.

3.4 INSPECTIONS

3.4.1 General

The Contractor shall inspect turbidity curtains, disturbed areas of the construction site, areas used for stockpiling and storage of materials that are exposed to precipitation that have not been finally stabilized, stabilization practices, structural practices, other controls, and area where vehicles exit the site at least once every 7 calendar days and within 24 hours of the end of any storm that produces 0.25 inches or more rainfall at the site. Where sites have been finally stabilized, such inspection shall be conducted at least once every month.

3.4.2 Inspections Details

Disturbed areas and areas used for material storage that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the SWMP shall be observed to ensure that they are operating correctly. Discharge locations or points shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles exit the site shall be inspected for evidence of off-site sediment tracking.

3.4.3 Inspection Reports

For each inspection conducted, the Contractor shall prepare a report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the SWMP, maintenance performed, and actions taken. The report shall be furnished to the Contracting Officer within 24 hours of the inspection as a part of the Contractor's daily CQC Report. A copy of the inspection report shall be maintained on the jobsite.

3.5 Removal and Disposal of the Silt Fence and Other Temporary Erosion Control Measures

After completion and approval of the work, the silt fences and other temporary erosion control measures shall be removed and disposed of off site at an approved disposal facility.

-- End of Section --

SECTION 01450 QUALITY CONTROL

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 880	(1995) Criteria for Use in Evaluation of Testing Laboratories and Organization for Examination and Inspection of Steel, Stainless Steel, and Related Alloys
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 3666	(2000) Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D 3740	(1999; Rev C.) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2000; Rev. A) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction
ASTM E 543	(1999) Agencies Performing Nondestructive Testing

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE EM 385-1-1	(2003) Safety and Health Requirements Manual
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1.2 SUBMITTALS

Submit the following in accordance with [Section 01330, Submittal Procedures](#).

1.2.1 SD-01, Pre-construction Submittal

- a. Quality Control (QC) Plan; G

1.3 INFORMATION FOR THE CONTRACTING OFFICER

Prior to commencing work on construction, the Contractor can obtain a single copy set of the current report forms from the Contracting Officer, or by calling the local Integrated Product Team-West (IPT-West) Quality Assurance (QA) Coordinator for an electronic version of the report forms. The report

forms will consist of the Contractor Production Report, Contractor Production Report (Continuation Sheet), Contractor QC Report, Contractor Quality Control (CQC) Report (Continuation Sheet), Preparatory Phase Checklist, Initial Phase Checklist, Rework Items List, and Testing Plan and Log. Other reports referenced below may be in formats customarily used by the Contractor, Testing Laboratories, etc. and will contain the information required by this specification.

Deliver the following to the Contracting Officer:

- a. CQC Report; original, by 10:00 AM the next working day after each day that work is performed.
- b. Contractor Production Report: Original, by 10:00 AM the next working day after each day that work is performed, attached to the CQC Report.
- c. Preparatory Phase Checklist: Original attached to the original CQC Report and one copy attached to each copy.
- d. Initial Phase Checklist: Original attached to the original CQC Report and one copy attached to each copy.
- e. Field Test Reports: Two copies, within 2 working days after the test is performed, attached to the CQC Report.
- g. Monthly Summary Report of Tests: Two copies attached to the CQC Report.
- g. Testing Plan and Log: Two copies, at the end of each month.
- h. Rework Items List: Two copies, by the last working day of the month.
- i. QC Meeting Minutes: Two copies, within 2 working days after the meeting.
- j. QC Certifications: As required by the paragraph entitled "QC Certifications."

1.4 QC PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. The QC program consists of a QC organization, a QC Plan, a QC Plan Meeting, a Coordination and Mutual Understanding Meeting, QC meetings, three phases of control, submittal review and approval, testing, completion inspections, and QC certifications and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations which comply with the requirements of this contract. The QC program shall cover on-site and off-site work and shall be keyed to the work sequence. No work or testing may be performed, unless the QC Manager is on the worksite. The QC Manager shall report to an officer of the firm and shall not be subordinate to the Project Superintendent or the Project Manager. The QC Manager, Project Superintendent and Project Manager must work together effectively. Although the QC Manager is the primary individual responsible for QC, all three individuals will be held responsible for the quality of

work on the job. The Project Superintendent will be held responsible for the quality of production.

1.4.1 Preliminary Work Authorized Prior to Approval

The only work that is authorized to proceed prior to the approval of the QC Plan is mobilization of storage and office trailers, temporary utilities, and surveying.

1.4.2 Approval

Approval of the QC Plan is required prior to the start of construction. The Contracting Officer reserves the right to require changes in the QC Plan and operations as necessary, including removal of personnel, to ensure the specified quality of work. The Contracting Officer reserves the right to interview any member of the QC organization at any time in order to verify the submitted qualifications. All QC organization personnel shall be subject to acceptance by the Contracting Officer. The Contracting Officer may require the removal of any individual for non-compliance with quality requirements specified in the contract.

1.4.3 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed change, including changes in the QC organization personnel, a minimum of 7 calendar days prior to a proposed change. Proposed changes shall be subject to acceptance by the Contracting Officer.

1.5 QC ORGANIZATION

1.5.1 QC Manager

1.5.1.1 Duties

Provide a QC Manager at the worksite to implement and manage the QC program. The only duties and responsibilities of the QC Manager are to manage and implement the QC program on this contract. The QC Manager shall not be designated as the safety competent person as defined by COE EM 385-1-1. The QC Manager is required to attend the QC Plan Meeting, attend the Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review and approval, ensure that testing is performed and provide QC certifications and documentation required in this contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by Testing Laboratory personnel and any other inspection and testing personnel required by this contract.

1.5.1.2 Qualifications

An individual with a minimum of 5 years experience as a Superintendent, Inspector, QC Manager, Project Manager, Project Engineer or Construction Manager on similar size and type construction contracts, which included the major trades that are part of this contract. The individual must be familiar with the requirements of COE EM 385-1-1, and have experience in the areas of hazard identification and safety compliance.

1.5.1.3 Construction Quality Management Training

In addition to the above experience and education requirements, the QC Manager shall have completed the course entitled "Construction Quality Management for Contractors." If the QC Manager does not have a current certification, they shall obtain the CQM course certification prior to start of field activities. This course is periodically offered by Naval Facilities Engineering Command, Southwest at San Diego, California.

1.5.2 Alternate QC Manager Duties and Qualifications

Designate an alternate for the QC Manager at the worksite to serve in the event of the designated QC Manager's absence. The period of absence may not exceed 2 weeks at one time, and not more than 30 workdays during a calendar year. The qualification requirements for the Alternate QC Manager shall be the same as for the QC Manager.

1.6 QUALITY CONTROL (QC) PLAN

1.6.1 Requirements

Provide, for approval by the Contracting Officer, a QC Plan submitted in a 3-ring binder with pages numbered sequentially that covers both on-site and off-site work and includes the following:

a. A table of contents listing the major sections identified with tabs in the following order:

- I. QC ORGANIZATION
- II. NAMES AND QUALIFICATIONS
- III. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL
- IV. OUTSIDE ORGANIZATIONS
- V. APPOINTMENT LETTERS
- VI. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER
- VII. TESTING LABORATORY INFORMATION
- VIII. TESTING PLAN AND LOG
- IX. PROCEDURES TO COMPLETE REWORK ITEMS
- X. DOCUMENTATION PROCEDURES
- XI. LIST OF DEFINABLE FEATURES
- XII. PROCEDURES FOR PERFORMING THE THREE PHASES OF CONTROL

b. A chart showing the QC organizational structure.

c. Names and qualifications, in resume format, for each person in the QC organization. Include the CQM course certifications for the QC Manager and Alternate QC Manager as required by the paragraphs entitled "Construction Quality Management Training" and "Alternate QC Manager Duties and Qualifications".

d. Duties, responsibilities and authorities of each person in the QC organization.

e. A listing of outside organizations such as, architectural and consulting engineering firms that will be employed by the Contractor and a description of the services these firms will provide.

f. Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager and stating that they are responsible for implementing and managing the QC program as described in this contract. Include in this letter the responsibility of the QC Manager and Alternate QC Manager to implement and manage the three phases of QC, and their authority to stop work, which is not in compliance with the contract. The QC Manager shall issue letters of direction to all other QC specialists outlining their duties, authorities, and responsibilities. Copies of the letters shall be included in the QC plan.

g. Procedures for reviewing, approving and managing submittals. Provide the name[s] of the person[s] in the QC organization authorized to review and certify submittals prior to approval. Provide the initial submittal of the Submittal Register as specified in section entitled "Submittal Procedures."

h. Testing laboratory information required by the paragraphs entitled "Accreditation Requirements" or "Construction Materials Testing Laboratory Requirements", as applicable.

i. A Testing Plan and Log that includes the tests required, referenced by the specification paragraph number requiring the test, the frequency, and the person responsible for each test.

j. Procedures to identify, record, track and complete rework items.

k. Documentation procedures, including proposed report formats.

l. List of definable features of work (DFW). A DFW is a task that is separate and distinct from other tasks, has the same control requirements and work crews. The list shall be cross-referenced to the Contractor's construction schedule and the specification sections. For projects requiring a progress chart, the list of DFWs shall include but not be limited to all items of work on the schedule.

m. Procedures for Performing the Three Phases of Control. For each DFW, provide the DFW's Preparatory and Initial Phase Checklists. Each list shall include a breakdown of quality checks that will be used when performing the QC functions, inspections, and tests required by the contract documents. The preparatory and initial phases and meetings shall be conducted with a view toward obtaining quality construction by planning ahead and identifying potential problems for each DFW.

1.7 QC PLAN MEETING

Prior to submission of the QC Plan, meet with the Contracting Officer to discuss the QC Plan requirements of this contract. The purpose of this meeting is to develop a mutual understanding of the QC Plan requirements prior to plan development and submission.

1.8 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the QC Plan, and prior to the start of construction, meet with the Contracting Officer to present the QC program required by this contract. The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, and the coordination of the Contractor's management, production and QC personnel. At the meeting, the Contractor will be required to explain in detail how three phases of control will be implemented for each DFW. As a minimum, the Contractor's personnel required to attend shall include an officer of the firm, the Project Manager, Project Superintendent, QC Manager, and Alternate QC Manager. Each additional Contractor who will be assigned QC responsibilities shall have a principal of the firm at the meeting. Minutes of the meeting will be prepared by the QC Manager and signed by the Contractor and the Contracting Officer. A copy of the signed minutes shall be provided to all attendees by the Contractor. Repeat the coordination and mutual understanding meeting when a new QC Manager is appointed.

Provide a room acceptable to the Contracting Officer for the 1-day meeting. The room shall be equipped with VCR and monitor equipment, overhead projector and a flip chart. Submit for Contracting Officer's approval the location, date and agenda for this meeting.

1.9 QC MEETINGS

After the start of construction, the QC Manager shall conduct weekly QC meetings at the worksite with the Project Superintendent. The QC Manager shall prepare the minutes of the meeting and provide a copy to the Contracting Officer within 2 working days after the meeting. The Contracting Officer may attend these meetings. The QC Manager shall notify the Contracting Officer at least 48 hours in advance of each meeting. As a minimum, the following shall be accomplished at each meeting:

- a. Review the minutes of the previous meeting
- b. Review the schedule and the status of work:
 - (1) Work or testing accomplished since last meeting
 - (2) Rework items identified since last meeting
 - (3) Rework items completed since last meeting
- c. Review the status of submittals:
 - (1) Submittals reviewed and approved since last meeting
 - (2) Submittals required in the near future
- d. Review the work to be accomplished in the next 2 weeks and documentation required:
 - (1) Establish completion dates for rework items

(2) Update the schedule showing planned and actual dates of the preparatory, initial and follow-up phases, including testing and any other inspection required by this contract

(3) Discuss construction methods and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFW

(4) Discuss status of off-site work or testing

(5) Documentation required

(6) Discuss upcoming Activity Hazard Analyses:

e. Resolve QC and production problems:

(1) Assist in resolving Request for Information issues

f. Address items that may require revising the QC plan:

(1) Changes in QC organization personnel

(2) Changes in procedures

g. Review Health and Safety Plan

1.10 THREE PHASES OF CONTROL

The three phases of control shall adequately cover both on-site and off-site work and shall include the following for each DFW.

1.10.1 Preparatory Phase

Notify the Contracting Officer at least 2 workdays in advance of each preparatory phase. This phase shall include a meeting conducted by the QC Manager and attended by the superintendent, and the foreman responsible for the definable feature. Document the results of the preparatory phase actions in the daily CQC Report and in the Preparatory Phase Checklist. Perform the following prior to beginning work on each DFW:

a. Review each paragraph of the applicable specification sections;

b. Review the contract drawings;

c. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required;

d. Review the testing plan and ensure that provisions have been made to provide the required QC testing;

e. Examine the work area to ensure that the required preliminary work has been completed;

f. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data;

- g. Discuss construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFW; and

- h. Review the safety plan and appropriate Activity Hazard Analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted.

1.10.2 Initial Phase

Notify the Contracting Officer at least 2 workdays in advance of each initial phase. When construction crews are ready to start work on a DFW, conduct the initial phase with, the superintendent, and the foreman responsible for that DFW. Observe the initial segment of the definable feature of work to ensure that the work complies with contract requirements. Document the results of the initial phase in the Daily CQC Report and in the Initial Phase Checklist. Repeat the initial phase for each new crew to work on site, or when acceptable levels of specified quality are not being met. Perform the following for each DFW:

- a. Establish the quality of workmanship required;
- b. Resolve conflicts;
- c. Ensure that testing is performed,
- d. Check work procedures for compliance with the Safety Plan and the appropriate Activity Hazard Analysis to ensure that applicable safety requirements are met.

1.10.3 Follow-up Phase

Perform the following for ongoing work daily, or more frequently as necessary until the completion of each DFW and document in the Daily CQC Report:

- a. Ensure the work is in compliance with Contract requirements;
- b. Maintain the quality of workmanship required;
- c. Ensure that testing is performed;
- d. Ensure that rework items are being corrected; and
- e. Perform safety inspections.

1.10.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same DFW if the quality of ongoing work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a definable feature is resumed after substantial period of inactivity, or if other problems develop.

1.10.5 Notification of Three Phases of Control for Off-Site Work

Notify the Contracting Officer at least 2 weeks prior to the start of the preparatory and initial phases.

1.11 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in section entitled "Submittal Procedures."

1.12 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

1.12.1 Accreditation Requirements

Construction materials testing laboratories performing work for Navy construction contracts will be required to submit the following:

- a. A copy of the Certificate of Accreditation and Scope of Accreditation by an acceptable laboratory accreditation authority.

Construction materials testing laboratories performing work for Navy construction contracts must be accredited by one of the laboratory accreditation authorities. The laboratory's scope of accreditation must include the ASTM standards listed in the paragraph titled "Construction Materials Testing Laboratory Requirements" as appropriate to the testing field. The policy applies to the specific laboratory performing the actual testing, not just the "Corporate Office".

1.12.2 Construction Materials Testing Laboratory Requirements

Provide an independent construction materials testing laboratory accredited by an acceptable laboratory accreditation authority to perform sampling and tests required by this Contract. Testing laboratories that have obtained accreditation by an acceptable laboratory accreditation authority listed in the paragraph entitled "Laboratory Accreditation Authorities" submit to the Contracting Officer, a copy of the Certificate of Accreditation and Scope of Accreditation. The scope of the laboratory's accreditation shall include the test methods required by the Contract. For testing laboratories that have not yet obtained accreditation by an acceptable laboratory accreditation authority listed in the paragraph entitled "Laboratory Accreditation Authorities," submit an acknowledgment letter from one of the laboratory accreditation authorities indicating that the application for accreditation has been received and the accreditation process has started, and submit to the Contracting Officer for approval, certified statements, signed by an official of the testing laboratory attesting that the proposed laboratory, meets or conforms to the ASTM standards listed below as appropriate to the testing field.

- a. Laboratories engaged in testing of construction materials shall meet the requirements of ASTM E 329.

b. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D 3740.

c. Laboratories engaged in nondestructive testing (NDT) shall meet the requirements of ASTM E 543.

d. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of Occupational Safety and Health Administration (OSHA) and U.S. Environmental Protection Agency (EPA).

1.12.3 Laboratory Accreditation Authorities

Laboratory accreditation authorities are the National Voluntary Laboratory Accreditation Program (NVLAP) administered by the National Institute of Standards and Technology, the American Association of State Highway and Transportation Officials (AASHTO) program, ICBO Evaluation Service, Inc. (ICBO ES), and the American Association for Laboratory Accreditation (A2LA) program.

Furnish to the Contracting Officer a copy of the Certificate of Accreditation and Scope of Accreditation. The scope of the laboratory's accreditation shall include the test methods required by the contract.

1.12.4 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

1.12.5 Test Results

Cite applicable contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify Contracting Officer immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. A testing laboratory representative authorized to sign certified test reports shall sign test results. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager. Furnish a summary report of field tests at the end of each month. Attach a copy of the summary report to the last Daily CQC Report of each month.

1.12.6 Test Reports and Monthly Summary Report of Tests

The QC Manager shall furnish the signed reports, certifications, and a summary report of field tests at the end of each month to the Contracting Officer. Attach a copy of the summary report to the last Daily CQC Report of each month.

1.13 QC CERTIFICATIONS

1.13.1 Contractor Quality Control Report Certification

Each CQC Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge, except as noted in this report."

1.13.2 Invoice Certification

Furnish a certificate to the Contracting Officer with each payment request, signed by the QC Manager, attesting that as-built drawings are current and attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements.

1.13.3 Completion Certification

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested and is in compliance with the Contract."

1.14 COMPLETION INSPECTIONS

1.14.1 Punch-out Inspection

Near the completion of all work or any increment thereof established by a completion time stated in the Contract Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the QC Manager shall conduct an inspection of the work and develop a "punch list," of items which do not conform to the approved drawings and specifications. Include in the punch list any remaining items on the "Rework Items List" which were not corrected prior to the Punch-out Inspection. The punch list shall include the estimated date by which the deficiencies will be corrected. A copy of the punch list shall be provided to the Contracting Officer. The QC Manager or staff shall make follow-on inspections to ascertain that all deficiencies have been corrected. Once this is accomplished the Contractor shall notify the government that the facility is ready for the government pre-final inspection.

1.14.2 Pre-Final Inspection

The Government will perform this inspection to verify that the facility is complete and ready to be occupied. A Government "Pre-final Punch List" may be developed as a result of this inspection. The QC Manager shall ensure that all items on this list are corrected prior to notifying the government that a final inspection with the customer can be scheduled. Any items noted on the pre-final inspection shall be corrected in timely manner and shall be accomplished before the contract completion date for the work or any particular increment thereof if the project is divided into increments by separate completion dates.

1.14.3 Final Acceptance Inspection

The QC Manager, the QC specialists, the Superintendent or other primary contractor management personnel, and the Contracting Officer's

representative will be in attendance at this inspection. Additional government personnel may be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the pre-final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final inspection stating that all specific items previously identified to the Contractor as being unacceptable, along with all the remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the government's additional inspection cost in accordance with the Contract Clause entitled "Inspection of Construction." When the Contracting Officer takes possession of partially completed work, it will be in accordance with Contract Clause "Use and Possession Prior to Completion".

1.15 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities.

1.15.1 Contractor Production Report

Reports are required for each day that work is performed and shall be attached to the CQC Report prepared for the same day. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Production Reports are to be prepared, signed and dated by the Project Superintendent and shall contain the following information:

- a. Date of report, report number, name of contractor, Contract number, title and location of Contract and Superintendent present.
- b. Weather conditions in the morning and in the afternoon including maximum and minimum temperatures.
- c. Identify work performed by corresponding Schedule Activity No., PC#, Modification No., etc.
- d. A list of Contractor personnel on the worksite, their trades, employer, work location, description of work performed, hours worked by trade, daily total work hours on worksite this date (incl. hours on continuation sheets), and total work hours from start of construction.
- e. A list of job safety actions taken and safety inspections conducted. Indicate that safety requirements have been met including the results on the following:
 - (1) Was a job safety meeting held this date? (If YES, attach a copy of the meeting minutes.)
 - (2) Were there any lost time accidents this date? (If YES, attach a copy of the completed OSHA report.)

(3) Was crane/manlift/trenching/scaffold/hv electrical/high work/hazmat work done? (If YES, attach a statement or checklist showing inspection performed.)

(4) Was hazardous material/waste released into the environment? (If YES, attach a description of incident and proposed action.)

f. Identify Schedule Activity No. related to safety action and list safety actions taken today and safety inspections conducted.

g. Identify Schedule Activity No., Submittal # and list equipment/material received each day that is incorporated into the job.

h. Identify Schedule Activity No., Owner and list construction and plant equipment on the worksite, including the number of hours used.

i. Include a "remarks" section in this report which will contain pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered and a record of visitors to the worksite. For each remark given, identify the Schedule Activity No. that is associated with the remark.

1.15.1.1 Contractor Production Report (Continuation Sheet)

Additional space required to contain daily information on the Contractor Production Report will be placed on its Continuation Sheet(s). An unlimited number of Continuation Sheets may be added as necessary and attached to the Production Report.

1.15.2 Contractor Quality Control Report

Reports are required for each day that work is performed and for every 7 consecutive calendar days of no-work and on the last day of a no-work period. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. CQC Reports are to be prepared, signed and dated by the QC Manager and shall contain the following information:

a. Date of report, report number, Contract Number, and Contract Title.

b. Indicate if preparatory phase work was performed today (Yes/No checkboxes).

c. If preparatory phase work was performed today (including on-site and off-site work), identify its Schedule Activity No. and DFW. The Index # is a cross reference to the Preparatory Phase Checklist. An example of the Index # is: 0025-P01, where "0025" is the CQC Report Number, "P" indicates Preparatory Phase, and "01" is the Preparatory Phase Checklist number(s) for this date. Each entry in this section must be accompanied with a corresponding Preparatory Phase Checklist.

d. Indicate if initial phase work was performed today (Yes/No checkboxes).

e. If initial phase work was performed today (including on-site and off-site work), identify its Schedule Activity No. and DFW. The Index # is a cross reference to the Initial Phase Checklist. An example of the Index # is: 0025-I01, where "0025" is the CQC Report Number, "I" indicates initial phase, and "01" is the Initial Phase Checklist number(s) for this date. Each entry in this section must be accompanied with a corresponding Initial Phase Checklist.

f. Results of the follow-up phase inspections held today (including on-site and off-site work), including Schedule Activity No., the location of the DFW, Specification Sections, etc. Indicate in the report for this DFW that the work complies with the Contract as approved in the initial phase, work complies with safety requirements, and that required testing has been performed and includes a list of who performed the tests.

g. List the rework items identified, but not corrected by close of business; along with its associated Schedule Activity Number.

h. List the rework items corrected from the rework items list along with the corrective action taken and its associated Schedule Activity Number.

i. Include a "remarks" section in this report, which will contain pertinent information including directions received, QC problem areas, deviations from the QC Plan, construction deficiencies encountered, QC meetings held, acknowledgement that as-built drawings have been updated, corrective direction given by the QC organization and corrective action taken by the Contractor. For each remark given, identify the Schedule Activity No. that is associated with the remark.

j. CQC Report certification, signature and date.

1.15.2.1 Contractor Quality Control Report (Continuation Sheet)

Additional space required to contain daily information on the Contractor Quality Control Report will be placed on its Continuation Sheet(s). An unlimited number of Continuation Sheets may be added as necessary and attached to the CQC Report.

1.15.3 Preparatory Phase Checklist

Each DFW that is in the preparatory phase shall have this checklist filled out for it. The checklist shall be identified by terminology consistent with the construction schedule. Attach this checklist to the CQC Report of the same date.

a. Specification Section, date of report, and contract number shall be filled out. Duplicate this information in the header of the second page of the report.

b. DFW, Schedule Activity No. and Index # entry and format will match entry in the preparatory phase section of the CQC Report. Duplicate this information in the header of the second page of the report.

c. Personnel Present: indicate the number of hours of advance notice that was given to the government representative and indicate (Yes/No checkboxes) whether or not the government representative was notified. Indicate the names of preparatory phase meeting attendees, their position and company/government they are with.

d. Submittals: indicate if submittals have been approved (Yes/No checkboxes), if no indicate what has not been submitted. Are materials on hand (Yes/No checkboxes) and if not, what items are missing? Check delivered material/equipment against approved submittals and comment as required.

e. Material Storage: indicate if materials/equipment are stored properly (Yes/No checkboxes) and if not, what action is/was taken.

f. Specifications: review and comment on Specification Paragraphs that describe the material/equipment, procedure for accomplishing the work and clarify any differences.

g. Preliminary Work & Permits: ensure that preliminary work is in accordance with the contract documents and necessary permits are on file, if not, describe the action taken.

h. Testing: identify who performs tests, the frequency, and where tests are to occur. Review the testing plan, report abnormalities, and if the test facilities have been approved.

i. Safety: indicate if the Activity Hazard Analysis has been approved (Yes/No checkboxes) and comment on the review of the applicable portions of the COE EM 385-1-1.

j. Meeting Comments: note comments and remarks during the preparatory phase meeting that were not addressed in previous sections of this checklist.

k. Other Items or Remarks: note any other remarks or items that were a result of the preparatory phase.

l. QC Manager will sign and date the checklist.

1.15.4 Initial Phase Checklist

Each DFW that is in the initial phase shall have this checklist filled out for it. The checklist shall be identified by terminology consistent with the construction schedule. Attach this checklist to the CQC Report of the same date.

a. Specification Section, date of report, and contract number shall be entered.

b. DFW, Schedule Activity No. and Index # entry and format will match entry in the initial phase section of the CQC Report.

- c. Personnel Present: indicate the number of hours of advance notice that was given to the government representative and indicate (Yes/No checkboxes) whether or not the government representative was notified. Indicate the names of initial phase meeting attendees, their position and company/government they are with.
- d. Procedure Compliance: comment on compliance with procedures identified at preparatory phase of control and assurance that work is in accordance with plans, specifications and submittals.
- e. Preliminary Work: ensure that preliminary work being placed is in compliance and if not, what action is/was taken.
- f. Workmanship: identify where initial work is located; if a sample panel is required (Yes/No checkboxes); is the initial work the sample (Yes/No checkboxes); and if Yes, describe the panel location and precautions taken to preserve the sample.
- g. Resolution: comment on any differences and the resolutions reached.
- h. Check Safety: comment on the safety review of the job conditions.
- i. Other: note any other remarks or items that were a result of the initial phase.
- j. QC Manager will sign and date the checklist.

1.15.5 Quality Control Validation

Establish and maintain the following in a series of 3-ring binders. Binders shall be divided and tabbed as shown below. These binders shall be readily available to the government's QA Team during all business hours.

- a. All completed Preparatory and Initial Phase Checklists, arranged by specification section.
- b. All milestone inspections, arranged by Activity/Event Number.
- c. A current up-to-date copy of the Testing and Plan Log with supporting field test reports, arranged by specification section.
- d. Copies of all contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.
- e. A current up-to-date copy of the Rework Items List.
- f. Maintain up-to-date copies of all punch lists issued by the QC Staff on the Contractor and sub-contractors and all punch lists issued by the government.

1.15.6 Testing Plan and Log

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was conducted, the date the test results were forwarded to the Contracting Officer, remarks and acknowledgement that an accredited or Contracting Officer approved testing laboratory was used. Attach a copy of the updated "Testing Plan and Log" to the last Daily CQC Report of each month.

1.15.7 Rework Items List

The QC Manager shall maintain a list of work that does not comply with the contract, identifying what items need to be reworked, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Rework Items List" to the last Daily CQC Report of each month. The Contractor shall be responsible for including on this list items needing rework including those identified by the Contracting Officer.

1.15.8 As-built Drawings

The QC Manager is required to ensure that the as-built drawings are kept current on a daily basis and marked to show deviations that have been made from the contract drawings. Ensure that each deviation has been identified with the appropriate modifying documentation (e.g. PC No., Modification No., Request for Information No., etc.). The QC Manager shall initial each deviation and each revision. Upon completion of work, the QC Manager shall furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

1.15.9 Report Forms

The following forms, are acceptable for providing the information required by the paragraph entitled "Documentation." While use of these specific formats are not required, any other format used shall contain the same information:

- a. Contractor Quality Control Report with continuation sheet(s)
- b. Contractor Production Report with continuation sheet(s)
- c. Preparatory Phase Checklist
- d. Initial Phase Checklist
- e. Testing Plan and Log
- f. Rework Items List

1.16 NOTIFICATION ON NON-COMPLIANCE

The Contracting Officer will notify the Contractor of any detected non-compliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the worksite, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply

promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

**SECTION 01500
TEMPORARY FACILITIES AND CONTROLS**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511 (1997) Reduced-Pressure Principle Backflow Prevention Assembly

FOUNDATION FOR CROSS-CONNECTION CONTROL AND HYDRAULIC RESEARCH (FCCCHR)

FCCCHR-CCC Manual of Cross-Connection Control

FCCCHR-USC List of Approved Backflow Prevention Assemblies

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

FHWA MUTCD (1988) Manual on Uniform Traffic Control Devices

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

NFPA 241 (1996) Safeguarding Construction, Alteration, and Demolition Operations

1.2 SUBMITTALS

Submit the following in accordance with [Section 01330, Submittal Procedures](#).

Pre-construction Submittals

Transportation and Disposal Plan; G

Remedial Work Plan; G

1.3 PRODUCT DATA

Retention cofferdam System – Submit manufacturer's material and installation information. (Portadam, Portadam, Inc. or approved equal) in accordance with Section 02300, Earthwork.

Portadam or approved equal; G

Dewatering pumps and discharge line data sheets; G

1.4 TEMPORARY UTILITIES

Reasonable amounts of the following utilities will be made available to the Contractor without charge. The point at which the government will deliver such utilities or services and the quantity available is as indicated. The Contractor shall pay all costs incurred in connecting, converting, and transferring the utilities to the work. The Contractor shall make connections, including providing backflow-preventing devices on connections to domestic water lines, providing meters; and providing transformers if needed; and make disconnections. Under no circumstances will taps to base fire hydrants be allowed for obtaining domestic water.

1.4.1 Special Restrictions Regarding Access of Vehicles and Parking

1.4.1.1 Interruption of Vehicular Traffic

If during the performance of work, it becomes necessary to modify vehicular traffic patterns at any locations, notify the Contracting Officer at least 5 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan shall be in accordance with state and local regulations and the FHWA Manual on Uniform Traffic Control Devices, Part VI. Make all notifications and obtain any permits required for modification to traffic movements outside Station's jurisdiction. Provide cones, signs, barricades, lights, or other traffic control devices and personnel required to control traffic.

1.5 STORAGE AREAS

Contractor shall be responsible for security of his property. The contract clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply.

1.6 TEMPORARY SANITARY FACILITIES

Provide adequate sanitary conveniences of a type approved for the use of persons employed on the work, properly secluded from public observation, and maintained in such a manner as required and approved by the Contracting Officer. Maintain these conveniences at all times without nuisance. Upon completion of the work, remove the conveniences from the premises, leaving the premises clean and free from nuisance. Dispose of sewage through connection to a municipal, district, or station sanitary sewage system. Where such systems are not available, use chemical toilets or comparably effective units, and periodically empty wastes into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Include provisions for pest control and elimination of odors.

Provide temporary sewer and sanitation facilities that are self-contained units with both urinals and stool capabilities. Ventilate the units to control odors and fumes and empty and clean them at least once a week or more often if required by the Contracting Officer. The doors shall be self-closing.

1.7 SITE OFFICE

1.7.1 Quality Control Manager Records and Field Office

Provide on the jobsite an office with approximately 200 square feet of useful floor area for the exclusive use of the QC Manager. Provide a weathertight structure with adequate heating and cooling, toilet facilities, lighting, ventilation, a 4 by 8 foot plan table, a standard size office desk and chair, computer station, and working communications facilities. Provide a door with a cylinder lock and windows with locking hardware. Make utility connections. Locate as directed, or where indicated. File quality control (QC) records in the office and make available at all times to the government. After completion of the work, remove the entire structure from the site.

1.8 DIVERSION DRAINAGE CONTROLS

1.8.1 COFFERDAM

Each construction zone shown on the drawings shall be dewatered before sediment removal with the use of a "Portadam Dam Retention System" (cofferdam) or approved equal by the Engineer. The retention dam system shall be installed for up to 10 feet for still water per manufacturers' installation requirements. The Engineer or manufacturer's representative shall inspect the first construction zone installation of the dam system.

1.8.2 DIVERSION DRAIN LINE AND PUMPS

Dewatering portable pumps shall be provided to bypass the channel flow around each active construction zone. The pumps shall be capable of running unattended for extended periods of time. At a minimum, two 100-horsepower (hp) portable trash pumps with an 8-inch discharge line for 1,100 feet shall be provided for a total capacity of 2,500 gallons per minute (gpm) (Godwin Pumps CD 225 or approved equal). One back-up pump for predicted storm events must be made available with a capacity of an additional 2,500 gpm (Godwin Pumps CD 250 with 10-inch discharge line or approved equal). Additional smaller pumps may be used as needed along Marriage Road.

The diversion drain line shall be a minimum 8-inch quick coupling steel or aluminum pipe ("Rain-for-Rent" or approved equal).

A 10-inch quick coupling steel or aluminum pipe line may be use through the cofferdam liner system or a siphon system may be installed from cofferdam to cofferdam in-place of one pump and discharge line system per Engineer and Navy approval of the dewatering plan.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 TEMPORARY PHYSICAL CONTROLS

3.1.1 Access Controls

3.1.1.1 Temporary Barricades

Contractor shall provide for barricading around all work areas to prevent public access.

3.1.1.2 Fencing

Fencing shall be provided around the construction site at all open excavations and tunnels to control access by unauthorized people. Fencing must be installed to be able to restrain a force of at least 250 pounds against it. Any existing fencing removal and/or temporary removal shall be approved by the Navy. This would include the North Patrol Road and Northern berm fence lines.

Enclose the project work area and Contractor laydown area with an 8-foot-high chain-link fence and gates. Remove the fence upon completion and acceptance of the work. Intent is to block wind and public view of the construction.

In addition, prior to the start of work, enclose those areas at the construction site, which are not within the construction fence, with a temporary safety fence, including gates and warning signs to protect the public from construction activities. Remove the fence from the worksite upon completion of the contract.

3.1.1.3 Signs

Place warning signs at the construction area perimeter designating the presence of construction hazards requiring unauthorized persons to keep out. Signs must be placed on all sides of the project, with at least one sign every 300 feet. All points of entry shall have signs designating the construction site as a hard hat area.

3.1.1.4 Traffic Work

All work around/involving roadways, to include roadway excavations and utility crossings, will be conducted in accordance with Manual of Traffic Control Devices. Contractors shall provide and ensure that appropriate road closure and detour signs are established as necessary for motor traffic management. All road closures shall be coordinated with the Contracting Officer in advance. Self-illuminated (lighted) barricades shall be provided during hours of darkness. Brightly colored (orange) vests are required for all personnel working in roadways. Road closures shall require a road closure plan showing the location of signage.

3.4 GRASS CUTTING

Cut grass (or annual weeds) within the construction and storage sites to a maximum 4 inch height at least once a week during the growing season, unless the grass area is not visible to the public. Trim the grass around fences at

time of grass cutting. Maintain grass or weeds on stockpiled earth as described above.

-- End of Section --

SECTION 01575
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 Code of Federal Regulations (CFR) 1910	Occupational Safety and Health Standards
40 CFR 261	Identification and Listing of Hazardous Waste
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

1.2 CONTRACTOR LIABILITIES FOR ENVIRONMENTAL PROTECTION

Contractors shall complete and provide documentation of environmental training required by federal, state, and local regulations.

1.3 DEFINITIONS

1.3.1 Sediment

Soil (i.e., sand, gravel, clay, and silts) that have eroded and been transported by water or wind.

1.3.2 Solid Waste

Garbage, refuse, debris, or other discharged material (except hazardous waste as defined in paragraph entitled "Hazardous Waste" or hazardous material as defined in paragraph entitled "Hazardous Material"), including solid, liquid, semisolid, or contained gaseous materials resulting from domestic, industrial, commercial, mining, or agricultural operations.

1.3.3 Debris

Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, leaves, and tree trimmings.

1.3.4 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.3.5 Hazardous Waste

Hazardous waste as defined in 40 CFR 261 or as defined by applicable state and local regulations.

1.3.6 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

1.4 SUBMITTALS

Submit the following in accordance with Section 01330, Submittal Procedures.

1.4.1 SD-01, Pre-construction Submittals

- a. Environmental Condition Report
- b. Habitat Restoration Plan
- c. Site Health and Safety Plan. Submit in accordance with the requirements contained in Section C, Part 3 of the Remedial Action Contract (RAC) Contract (29 CFR 1910).
- d. Stormwater Management Plan (SWMP)
- e. Temporary Power and Utility Plan; G

1.4.2 SD-06

- a. Erosion and Sediment Control Inspection Reports; G

1.4.3 SD-07, Certificates

- a. Solid Waste Disposal Permit/manifests; G
- b. Disposal Permit/manifests for nonhazardous and hazardous wastes; G

1.5 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with federal, state, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

1.6 ENVIRONMENTAL PROTECTION PLAN

1.6.1 Contents of Environmental Protection Plan

- a. Any hazardous materials planned for use on the station shall be included in the station Hazardous Materials Tracking Program

maintained by the Safety Department. To assist this effort, the Contractor shall submit a list (including quantities) of hazardous materials to be brought to the station and copies of the corresponding Material Safety Data Sheets (MSDS). Submit this list to the Contracting Officer. At project completion, remove any hazardous material brought onto the station. Account for the quantity of hazardous materials brought to the station, the quantity used or expended during the job, and the leftover quantity that (1) may have additional useful life as a hazardous materials and shall be removed by the Contractor, or (2) may be a hazardous waste, which shall then be removed as specified herein.

- b. The Environmental Protection Plan shall list and quantify any hazardous waste to be generated during the project.
- c. In accordance with station regulations, store hazardous waste near the point of generation up to a total quantity of one quart of toxic waste or 55 gallons of hazardous waste. Move any volume that exceeds these quantities to a hazardous waste-permitted area within 3 days. Prior to generation of hazardous waste, contact the Contracting Officer for labeling requirements for storage of hazardous wastes.
- d. In accordance with station regulation, substitute materials as necessary to reduce the generation of hazardous waste and include a statement to that effect in the Environmental Protection Plan.
- e. Contact Contracting Officer for conditions in the area of the project that may be subject to special environmental procedures. Include this information in the pre-construction survey. Describe in the Environmental Protection Plan and permits required prior to working in the area, and contingency plans in case an unexpected environmental condition is discovered.
- f. Obtain permits for handling hazardous waste, and deliver completed documents to the Contracting Officer for review. File the documents with the appropriate agency, and complete disposal with the approval of the Contracting Officer. Deliver correspondence with the state concerning the environmental permits and completed permits to the Contracting Officer.

1.6.2 Contents of SWMP

The project construction SWMP and the requirement specified in Section 01356, Stormwater Management Measures, shall be followed.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified.

3.1.1 Land Resources

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees, shrubs, or soil cover vegetation without the Contracting Officer's permission.

3.1.1.1 Protection of Vegetation

Protect existing vegetation and trees that are to remain and which may be injured, bruised, defaced, or otherwise damaged by construction operations. By approved excavation, remove any trees (if any) with 30 percent or more of their root systems destroyed.

3.1.1.2 Replacement

Revegetate with approved seeds and/or plants any area scarred or damaged by equipment operations. Replacement shall be with equivalent plant type. Obtain Contracting Officer's approval before replacement.

3.1.2 Water Resources

Prevent oil or hazardous substances from entering the ground, drainage areas, or navigable waters. Surround all temporary fuel oil or petroleum storage tanks with a temporary berm or containment of sufficient size and strength to contain the contents of the tanks, plus 10 percent freeboard for precipitation.

3.1.3 Fish and Wildlife Resources

Do not disturb fish and wildlife. Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as indicated or specified.

3.2 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work. The Government retains ownership and control over historical and archaeological resources.

3.3 NOISE

Make the maximum use of low-noise emission products, as certified by the U.S. Environmental Protection Agency (EPA). Blasting or use of explosives will

not be permitted without written permission from the Contracting Officer, and then only during the designated times.

3.4 EROSION AND SEDIMENT CONTROL MEASURES

3.4.1 Burnoff

Burnoff of the ground cover is not permitted.

3.4.2 Protection of Erodible Soils

Immediately finish the earthwork brought to a final grade, as indicated or specified. Immediately protect the side slopes and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

3.4.3 Temporary Protection of Erodible Soils

Use the methods specified in Section 01356, Stormwater Management Measures, and the project construction SWMP.

3.5 CONTROL AND DISPOSAL OF WASTES

Generated wastes are to be managed, stored and disposed of per the Transportation and Disposal Plan.

3.6 DUST CONTROL

Keep dust down at all times, including during non-working periods. Sprinkle or treat the soil at the site, haul roads, and other areas disturbed by operations with dust suppressants. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping or wet power brooming. If street sweepers are used, brooms shall not be wire.

3.7 METHANE GAS

Take precautions to avoid all ignition sources on the site during construction due to potentially explosive concentrations of methane gas.

-- End of Section --

**SECTION 01720
SURVEYING**

PART 1 GENERAL

1.1 PROJECT DESCRIPTION

- A. A land surveyor licensed in the state of California will provide field engineering services.
- B. The Contractor shall provide field survey staking and will maintain control points outside the construction area. The Contractor shall be responsible for maintaining the survey stakes.

1.2 RELATED SECTIONS AND DOCUMENTS

- A. Remedial Design Drawing Package at former Naval Air Station (NAS), Moffett Field

1.3 QUALITY CONTROL (QC)

- A. QC Engineer will review all survey QC documentation to verify that all applicable QC procedures have been followed in accordance with specifications and drawings.

1.4 SUBMITTALS

- A. Submit name, address, telephone number, and proof of land surveyor registration of surveyor before starting survey work.
- B. On request, submit documentation verifying accuracy of survey work.
- C. The Contractor shall submit certificates signed by the land surveyor that the elevations and locations of the work are in conformance with the specifications when requested by the QC Engineer.
- D. Survey drawings.

1.5 PROJECT RECORD DOCUMENTS

- A. Maintain a complete and accurate log of control and survey work as it progresses.

1.6 EXAMINATION

- A. Verify locations of survey control points prior to starting work.
- B. Promptly provide notification to Navy of any discrepancies discovered.

1.7 SURVEY REFERENCE POINTS

- A. Contractor will locate and protect survey control and reference points.
- B. Horizontal control datum for survey is North American Datum of 1983. Vertical control datum is North American Vertical Datum of 1988.
- C. Contractor shall provide additional protection as necessary for the survey control points prior to starting site work. The Contractor shall preserve permanent reference points during construction.
- D. The loss or destruction of any reference point or relocation required because of changes in grades or other reasons shall promptly be reported to the Navy.
- E. If the Contractor disturbs survey control points, the Navy shall be notified. The Contractor shall replace disturbed survey control points based on original survey control at the Contractor's expense. No changes shall be made without prior written notice to the Navy.

1.8 SURVEY REQUIREMENTS

- A. Utilize recognized engineering survey practices.
- B. Conduct staking every 50 feet along the Northern Channel.
- C. Survey confirmation sample locations in channel and ditches (1 sample every 50 linear feet), in first 800-foot section of Northern Channel slopes, and in debris pile.
- D. Survey channel and ditches prior to excavation, after excavation, and final as-built grade.
- E. Conduct staking for cut and fill in channel.
- F. Conduct staking for cut and fill for haul roads and turnouts, and as-built conditions (if left in place after construction activities).
- G. Survey dimensions of sediment stockpiles, sub-base below liner, and protective cover over liner.
- H. Survey dimensions of collection/retention basin and conduct staking for cut and fill.
- I. Survey all as-built conditions (debris pile, 800-foot section of slope, etc.).
- J. Survey measurements will have horizontal and vertical tolerances within ± 0.2 feet.
- K. Licensed surveyor will sign surveying drawings.

1.9 SURVEYS FOR MEASUREMENT

- A. Perform surveys to determine quantities of unit work and to establish measurement reference lines. Notify Navy prior to starting work.

PART 2 PRODUCTS

- A. Work shall be performed using sound and reliable materials and equipment.

PART 3 EXECUTION

3.1 QUALITY CONTROL

- A. QC Engineer shall sign surveyor's field notes or keep duplicate field notes and verify quantities.
- B. QC Engineer shall verify that all survey work is in accordance with the specifications and drawings.

3.2 LAYING OUT THE WORK

- A. Construction staking shall include the use of vertical and horizontal survey control points to establish construction survey points and construction centerlines; establish bench marks as necessary; setting stakes for slopes, subgrade, and any staking required for control elevations and other points or elevations deemed necessary for proper control of the Work.
- B. Recognized engineering survey practices shall be utilized.
- C. The accuracy of all the Contractor's stakes, alignments and grades is its respective responsibility. The Navy may check the Contractor's stakes, alignments and grades at any time. However, this check does not relieve the Contractor of its responsibility to construct the work in accordance with these specifications.
- D. The surveyor shall provide the QC Engineer with the survey notes and calculations for checking of quantities on a daily basis. However, this check does not relieve the Contractor of its responsibility to construct the work in accordance with the specifications.

-- End of Section --

**SECTION 02231
CLEARING AND GRUBBING**

PART 1 GENERAL

1.1 SUBMITTALS

1.1.1 DELIVERY, STORAGE, AND HANDLING

Deliver materials to, store at the site, and handle in a manner that will maintain the materials in their original manufactured or fabricated condition until ready for use.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 PROTECTION

3.1.1 Roads and Walks

Keep roads and walks free of dirt and debris at all times.

3.1.2 Wetland, vegetation and Existing Facilities

Protection shall be in accordance with [Section 01575](#), Temporary Environmental Controls.

3.1.3 Utility Lines

Protect existing utility lines that are indicated to remain from damage. Notify the Contracting Officer immediately of damage to or an encounter with an unknown existing utility line. The Contractor shall be responsible for the repairs of damage to existing utility lines that are indicated or made known to the Contractor prior to start of clearing and grubbing operations. When utility lines which are to be removed or are encountered within the area of operations, the Contractor shall notify the Contracting Officer in ample time to minimize interruption of the service. Refer to [Section 01310](#), Administrative Requirements, and [Section 01575](#), Temporary Environmental Controls, for additional utility protection.

3.2 CLEARING

Shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including downed timber, snags, brush, and heavy grass vegetation occurring within the areas to be cleared. Cut off flush with or below the original ground surface trees, stumps, roots, brush, and other vegetation in areas to be cleared, except for trees and vegetation indicated or directed to be left standing.

3.3 TREE REMOVAL

Where indicated, remove designated trees and stumps from areas outside those areas specified for clearing and grubbing.

3.5 GRUBBING

Remove and dispose of roots larger than 3 inches in diameter, matted roots, and designated stumps from the indicated grubbing areas. Excavate this material together with logs, organic and other vegetative debris to a depth of not less than 12 inches below the original soil surface in areas indicated to be grubbed and in areas indicated as construction areas under this contract. Do not remove any channel berm material. Grind in place any stumps or matted roots in contact with channel berm. Fill depressions made by grubbing with suitable embankment fill material to conform with the existing adjacent surface of the ground.

3.6 DISPOSAL OF CLEARED AND GRUBBED MATERIALS

Remove from the project site and dispose of off station. Burning will not be permitted.

-- End of Section --

**SECTION 02300
EARTHWORK**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 698	(1998) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D 1556	(1990; Revised 1996e1) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2216	(1998) Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996e1) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2974	(1987) Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Materials
ASTM D 3017	(1988; R 1996e1) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4972	(1995a) Test Method for pH of Soils

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the government. The following shall be submitted in accordance with [Section 01330](#), Submittal Procedures.

Product Data

Portable Cofferdam: Submit manufacturer's material and installation information. (Portadam, Portadam, Inc. or approved equal) in accordance with [Section 01500](#), Temporary Facilities and Controls (see Section 01500).

Soil drying additives: Submit manufacturers information

Test Reports

Borrow Source Assessment; ASTM D 698
Select Fill and Topsoil Material Tests; ASTM D 698
Moisture Content and Density Tests of In-Place Select Fill; ASTM D 1556

Borrow Source Assessment Report at least 5 days prior to select fill and topsoil placement. No select fill or topsoil shall be placed until the Borrow Source Assessment Report is approved. The report shall include the following: location of each borrow source, estimated available quantity of borrow, logs of subsurface explorations, and laboratory test results.

1.3 EQUIPMENT

Equipment used to place the select fill and topsoil layers shall be as described in the approved Materials Handling Plan. Equipment shall not accelerate or brake suddenly, turn sharply, or be operated at speeds exceeding 25.0 miles per hour.

Equipment shall be used to dewater construction zones in accordance with [Section 01450](#), shall be quality control, and [Section 01500](#), Temporary Facilities and Controls.

PART 2 PRODUCTS

2.1 GRAVEL

Gravel material used for haul roads, drainage layer over the liner and the berm section in the stockpile area shall be 1-inch crush aggregate. The gravel drainage layer in the truck and equipment decon pad shall be 1-inch crush aggregate. One inch rock shall also be used to stabilize construction area as per the SWMP.

2.2 SELECT FILL

Select fill shall be granular soil material used for the berm sub-base, turnouts and embankment foundation above the water line. No imported fill material will be used below the water line except for embankment material used for turnouts that will be removed at the end of the project. The select fill shall comply with the criteria listed in [Table 1](#) and shall be free of debris, frozen materials, angular rocks, roots, and organics.

2.3 TOPSOIL

Topsoil shall be at a minimum the final 6 inches lift of soil to support vegetative cover. The topsoil shall consist of natural, friable soil that is representative of soils in the vicinity, which produce heavy growths of crops, grass, or other vegetation and is reasonably free from underlying subsoil, clay lumps, objectionable weeds, litter, brush, matted roots, toxic substances, or any material that might be harmful to plant growth or be a hindrance to grading, planting, or maintenance operations. Clean soil from channel and/or ditch bottoms, drained ponds, or eroded areas shall be dried to an approved moisture content, salt content, and tested for metal contamination and approved by the Navy prior to use. Topsoil shall also comply with the criteria listed in Table 1.

TABLE 1
REQUIRED PHYSICAL PROPERTIES OF SELECT FILL AND TOPSOIL

Property	Test Value	Test Method
Select Fill		
Soil classification	(SW, SP, GW, GP - above the water line) (SC, CL - below the water line) Clayey sand (SC)	ASTM D 2487
Max. particle size (inches)	0.75	ASTM D 422
Topsoil		
Max. particle size (inches)	1	ASTM D 422
pH	5-7	ASTM D 4972
Organic content (%)	5-20	ASTM D 2974

2.4 COFFERDAM SYSTEM

Portable Cofferdam: (Portadam, Portadam, Inc. or approved equal).

2.5 SOIL ADDITIVES

If required, dredge sediment material shall be dried with soil additives, namely Waste Lock® 770. Specifications and the material safety data sheet for Waste Lock 770 are attached.

PART 3 EXECUTION

3.1 BORROW SOURCE ASSESSMENT

3.1.1 Select Fill

3.1.1.1 Classification Testing

Borrow source assessment tests shall be performed on each principal type or combination of materials proposed for use in the select fill layer to ensure compliance with specified requirements. At least one set of borrow

assessment tests shall be performed on each borrow source proposed for use. A set of borrow source assessment tests shall consist of Atterberg limits (ASTM D 4318), particle size analysis (ASTM D 422), and moisture content (ASTM D 2216). Based on borrow source assessment testing, soils shall be classified in accordance with ASTM D 2487.

3.1.1.2 Moisture-density (Compaction) Testing

A representative sample from each principal type or combination of borrow materials shall be tested to establish compaction curves using ASTM D 698. At least one compaction test shall be performed on each borrow source proposed. A minimum of five points shall be used to develop each compaction curve. During construction, placement of select fill shall conform to the following requirements:

- a. The minimum allowable dry density shall be no less than 90 percent of maximum dry density as determined in accordance with ASTM D698.
- b. The allowable moisture content range shall be determined by the Proctor curve.

3.1.2 Topsoil

Testing shall be performed on representative samples of each principal type or combination of topsoil materials. At least one set of tests shall be performed on each borrow source proposed. Testing shall consist of the determination of maximum particle size in accordance with ASTM D 422, pH in accordance with ASTM D 4972, and organic content in accordance with ASTM D 2974.

3.1.3 Chemical Contamination Testing

Borrow used for the select fill and topsoil layers shall be free of contamination. Each proposed borrow source shall be sampled and analyzed for chemical contamination in accordance with [Section 01450](#), Contractor Quality Control.

3.2 INSTALLATION

3.2.1 Select Fill Placement

3.2.1.2 Subsequent Lifts of Select Fill

The loose lift thickness of each subsequent lift shall be no greater than 8 inches and compacted with a suitable compactor. The top surface of the select fill layer shall be finish graded and as-built surveyed prior to placement of the topsoil layer.

3.2.2 Topsoil Placement

Topsoil shall not be placed when the subgrade is excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading. Topsoil shall be placed in one lift and shall be evenly spread to a final compacted thickness of 6 inches. Topsoil shall be traffic-compacted using approved placement equipment. On slopes, topsoil shall be placed from the bottom of the slope upward.

3.2.3 Cofferdam

Portable Cofferdam: install per manufacturer's approved installation information. Dewater construction zones per approved dewatering plan before sediment removal (Portadam, Portadam, Inc. or approved equal).

3.3 CONSTRUCTION TOLERANCES

Finished surfaces shall be uniformly graded and shall be free from depressions, mounds, or windrows. The top surface of the select embankment fill layer and topsoil layer shall be no greater than plus or minus 4 inches for grades above the water lines as shown on the drawings. No tolerance greater than 2 inches below the water line in the invert of the ditches or channel will be permitted.

3.4 CONSTRUCTION TESTS

3.4.1 Select Fill and Topsoil Material Tests

During construction of the select embankment fill layer, representative samples shall be taken for testing at the frequencies listed in Table 2 from the borrow source or from on-site stockpiles. Test results must comply with the requirements listed in Part 2 Products or the material will be rejected for use.

TABLE 2
SELECT FILL AND TOPSOIL MATERIAL TESTING FREQUENCIES

Property	Frequency	Test Method
Select embankment Fill		
Grain-size analysis	2,000 cubic yards	ASTM D 422
Atterberg limits	2,000 cubic yards	ASTM D 4318
Proctor Test (Note 1)	5,000 cubic yards	ASTM D 698
Topsoil		
Grain-size analysis for maximum particle size	2,000 cubic yards	ASTM D 422
pH	2,000 cubic yards	ASTM D 4972
Organic content	2,000 cubic yards	ASTM D 2974

Note 1: Compaction test results shall be compared with the results obtained during the borrow source assessment. When there are significant differences, adjustments to the acceptable moisture content or density ranges shall be proposed by the contractor for approval.

3.4.2 Moisture Content and Density Tests of In-place Select Fill
Moisture content and density tests shall be performed in accordance with Table 3. Density requirements will not be enforced for the first lift of the select foundation fill layer.
-0.33

TABLE 3
SELECT FILL MATERIAL IN-PLACE TESTING FREQUENCING

Nuclear moisture content	10,000 square feet	ASTM D 3017
Standard moisture content	1 for every 20 rapid tests	ASTM D 2216
Nuclear density	10,000 square feet	ASTM D 2922
Standard density	1 for every 20 rapid tests	ASTM D 1556 or ASTM D 2167

3.4.2.1 Test Frequencies and Locations

Each day that select fill is placed, a minimum of one set of standard moisture content and density tests shall be performed. Nuclear density and moisture content tests shall be checked at the frequencies shown in Table 3. Standard tests shall be performed at locations, which are as close as possible to the locations of the nuclear tests being checked.

3.4.2.2 Nuclear Density and Moisture Content Tests

Nuclear density readings shall be taken in the direct transmission mode. Nuclear density and moisture calibration curves shall be checked and adjusted in accordance with the procedures described in ASTM D 2922 and ASTM D 3017.

The nuclear gauge calibration checks shall be made at the beginning of a job, on each different type of material to be placed, and at intervals as directed. Nuclear density and moisture content gauges shall also be standardized daily in accordance with ASTM D 2922 and ASTM D 3017.

3.4.2.3 Test Results

Field moisture content and density test results shall be compared to the compaction curve for the appropriate material type being tested. If test results are not within the acceptable range for moisture content or density, as described in subparagraph Moisture-Density (Compaction) Testing, three additional tests shall be performed near the location of the failed parameter. If all retests pass, no additional action shall be taken. If any of the retests fail, the lift of soil shall be repaired out to the limits defined by passing tests for that parameter. The area shall then be retested as directed.

3.5 PROTECTION

3.5.1 Damage

Erosion rills that exceed 1 inch in depth or other damage that occurs shall be repaired and grades re-established at no additional cost to the government. Repairs to the select embankment fill layer or topsoil layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

3.5.2 Stockpiles

Sediment removal shall be stockpiled on the membrane-lined stockpile area north of Building 191. Storage or stockpiling of any material on the completed surface of the select fill layer or topsoil layer will not be permitted without approval of the Engineer.

-- End of Section --

**SECTION 02620
SUBDRAINAGE SYSTEM**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2751	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM F 405	(1997) Corrugated Polyethylene (PE) Tubing and Fittings

1.2 SUBMITTALS

1.2.1 SD-07, Certificates

- a. Geotextile fabric
- b. Pipe for subdrains

Certifications from the manufacturers attesting that materials meet specification requirements. Certificates are required for drain pipe, fittings, and geotextile fabric.

1.3 DELIVER, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with minimum handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. During shipment and storage, geotextile fabric shall be wrapped in burlap or similar heavy-duty protective covering. The storage area shall protect the fabric from mud, soil, dust, and debris. Geotextile fabric materials that are not to be installed immediately shall not be stored in direct sunlight. Plastic pipe shall be installed within 6 months from the date of manufacture unless otherwise approved.

1.3.2 Handling

Materials shall be handled in such a manner as to ensure delivery to the trench in sound undamaged condition. Pipe shall be carried and not dragged to the trench.

PART 2 PRODUCTS

2.1 PIPE FOR SUBDRAINS

Pipe for subdrains shall be a plastic type pipe as listed below with sizes as indicated on the drawings.

2.1.1 Plastic Pipe

Plastic pipe shall contain ultraviolet inhibitor to provide protection from exposure to direct sunlight.

2.1.1.1 Acrylonitrile-Butadiene-Styrene (ABS) Piping and Fittings

ABS piping and fittings shall conform to ASTM D 2751, with maximum SDR of 35.

2.1.2.2 Polyvinyl Chloride (PVC) Pipe and Fittings

PVC pipe and fittings shall conform to ASTM D 3034.

2.1.1.3 Corrugated Polyethylene (PE) Pipe and Fittings

Use ASTM F 405 for pipes 3 to 6 inches in diameter. Fittings shall be manufacturer's standard type and shall conform to the indicated specification.

2.1.1.4 Pipe Perforations

Water inlet area shall be a minimum of 0.5 square inch per linear foot. Manufacturer's standard perforated pipe that essentially meets these requirements may be substituted with prior approval of the QC Engineer.

- a. Circular Perforations in Plastic Pipe: Circular holes shall be cleanly cut not more than 3/8 inch or less than 3/16 inch in diameter and arranged in rows parallel to the longitudinal axis of the pipe. Perforations shall be approximately 3 inches center-to-center along rows. The rows shall be approximately 1-1/2 inches apart and arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. The rows shall be spaced over not more than 155 degrees of circumference. The spigot or tongue end of the pipe shall not be perforated for a length equal to the depth of the socket, and perforations shall continue at uniform spacing over the entire length of the pipe.
- b. Slotted Perforations in Plastic Pipe: Circumferential slots shall be cleanly cut so as not to restrict the inflow of water and uniformly spaced along the length and circumference of the tubing. Width of slots shall not exceed 1/8 inch nor be less than 1/32 inch. The length of individual slots shall not exceed 1-1/4 inches on 3-inch-diameter tubing, 10 percent of the tubing inside nominal circumference on 4- to 8-inch diameter tubing, and 2-1/2 inches on 10-inch-diameter tubing. Rows of slots shall be symmetrically spaced so that they are fully contained in two quadrants of the pipe. Slots shall be centered in the valleys of the corrugations of profile wall pipe.

2.2 GEOTEXTILE FABRIC

Geotextile fabric shall be as specified in Section 02661, Geotextile Products (Geomembrane, Geotextile, Geonet).

PART 3 EXECUTION

3.1 EXCAVATION AND BEDDING FOR SUBDRAIN SYSTEMS

Drainage trenches shall be a minimum of 6 inches wide and a minimum of 8 inches deep and shall be cut into a thoroughly compacted subgrade so that the drainage lines slope uniformly. Trenching shall at no time enter into the cobble layer. Spoil from the trenches should be removed so that the floor of the trench is smooth and clean.

3.2 CLEAN-OUTS AND COLLECTION SUMPS

Clean-outs and collection sumps with frames and covers shall be installed at the locations indicated. Risers shall be constructed of pre-cast concrete pipe protective sleeve over a plastic pipe extended pipe fitting. Joining of riser pipes to the subdrain system shall be with a wye type or a long sweeping elbow fitting.

3.3 INSTALLATION OF GEOTEXTILE FABRIC AND PIPE FOR SUBDRAINS

3.3.1 Installation of Geotextile Fabric

3.3.1.1 Trench Lining and Overlaps

Trenches to be lined with geotextile fabric shall be graded to obtain smooth side and bottom surfaces so that the fabric will not bridge cavities in the soil or be damaged by projecting rock. The fabric shall be laid flat but not stretched on the soil. Overlaps shall be at least 4 inches.

3.3.2 Installation of Pipe for Subdrains

3.3.2.1 Pipelaying

Each pipe shall be carefully inspected before it is laid. Any defective or damaged pipe shall be rejected. No pipe shall be laid when the trench conditions or weather is unsuitable for such work. Water shall be removed from trenches by sump pumping or other approved methods. A layer of gravel, as specified in Section 02300, Earthwork, should be placed in the trench to a minimum depth of 1 inch. The pipe shall be laid to the grades and alignment as indicated with a minimum positive slope of 0.5 percent. The pipe shall be bedded to the established gradeline. Perforations shall be centered on the bottom of the pipe. Pipes of either the bell-and-spigot type or the tongue-and-groove type shall be laid with the bell or groove ends upstream. All pipes in place shall be approved before backfilling.

3.3.2.2 Jointings

- a. ABS: Solvent cement or elastomeric joints for ABS pipe shall be in accordance with ASTM D 2751. Dimensions and tolerances shall be in accordance with TABLE II of ASTM D 2751.

- b. PVC Pipe: Joints shall be in accordance with the requirements of ASTM D 3034.
- c. Perforated Corrugated PE Pipe: Perforated corrugated PE drainage pipe shall be installed in accordance with the manufacturer's specifications and as specified herein. A pipe with physical imperfections shall not be installed. No more than 5 percent stretch in a section will be permitted.

3.4 INSTALLATION OF GEOTEXTILE MATERIAL AND BACKFILLING COVER SOIL FOR SUBDRAINS

After pipe for subdrains has been laid, inspected, and approved, drainage gravel material shall be placed around and over the pipe as indicated. The geotextile fabric shall be wrapped with a minimum 4-inch overlap. The cover material shall be placed in 6-inch-thick layers, and each layer shall be thoroughly compacted by hand-held mechanical tampers or rammers and not with heavy equipment type compactors to obtain the required density. Compaction of overlying backfill material shall be in accordance with the applicable provisions specified in [Section 02300](#), Earthwork.

-- End of Section --

SECTION 02661
GEOSYNTHETIC PRODUCTS (GEOMEMBRANE, GEOTEXTILE, GEONET)

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Geomembrane liners system for the stockpile barrier system, detention pond and cofferdam. Geotextiles for liner protection, and subgrade stabilization Geonet for subdrain system.
 - a. Polyvinyl chloride liners (PVC Liner), Geomembrane
 - b. Geotextile, Geonet drainage layer
 - c. Soil amendments
 - d. Liner anchoring trench and backfill
- B. Related Sections:
 - 1. [Section 02300 - Earthwork.](#)

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM) International:
 - 1. ASTM D 413 - Standard Test Methods for Rubber Property - Adhesion to Flexible Substrate.
 - 2. ASTM D 471 - Standard Test Method for Rubber Property - Effect of Liquids.
 - 3. ASTM D 751 - Standard Test Methods for Coated Fabrics.
 - 4. ASTM D 792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
 - 5. ASTM D 882 - Standard Test Methods for Tensile Properties of Thin Plastic Sheeting.
 - 6. ASTM D 1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.
 - 7. ASTM D 1203 - Standard Test Methods for Volatile Loss from Plastics Using Activated Carbon Methods.
 - 8. ASTM D 1204 - Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
 - 9. ASTM D 1593 - Standard Specification for Nonrigid Vinyl Chloride Plastic Film and Sheeting.
 - 10. ASTM D 1693 - Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
 - 11. ASTM D 1790 - Standard Test Method for Brittleness Temperature of Plastic Sheeting by Impact.
 - 12. ASTM D 2136 - Standard Test Methods for Rubber Property - Brittleness Point of Flexible Polymers and Coated Fabrics.
 - 13. ASTM D 3083 - Standard Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining.

14. ASTM D 5884 - Standard Test Method for Determining the Tearing Strength of Internally Reinforced Geomembrane.
15. ASTM G 26 - Standard Practice for Operating Light-Exposure Apparatus (Xenon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.

1.3 SUBMITTALS

- A. Pre-construction: provide manufacturer and installer qualifications
- B. Shop Drawing: Show joining details and special batten and pipe boot details.
- C. Product Data: Submit Material Safety Data Sheet (MSDS) data on liner adhesive, liner and geotextile material. Provide warranty.
- D. Manufacturer's Instructions: Submit special procedures for liner seaming installation.
- E. Certificates: Certify Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Accurately record actual pipe penetration locations, if any.

1.5 QUALITY CONTROL

- A. Perform Work in accordance with Public Work's standard. Standard specification for public works construction "Green Book" latest edition (Section 213 "Engineering Fabrics", Section 300-8 "Geotextile for Drainage", Section 300-9 "Geotextile for Erosion Control", and 300-10 "Geotextile for Separation").
- B. Seam testing to be observed by the QC/engineer.
- C. Maintain two copies of material MSDS and testing documents on site.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 3 years documented experience.
- B. Installer: Company specializing in performing work of this section approved by manufacturer and quality control (QC)/Engineer.

1.7 PRE-INSTALLATION MEETINGS

- A. Administrative Requirements: Pre-installation meeting.
- B. Convene minimum 1 week prior to commencing work of this section.
- C. QC meetings as per plan.

1.8 DELIVERY, STORAGE AND HANDLING

- A. Product Requirements: Requirements for transporting, handling, storing, and protecting products per manufacture instructions.
- B. Transport and handle liner with equipment designed to protect liner from damage.
- C. Store products in dry areas and protect form sun exposure or other damaging elements.
- D. Keep products dry.
- E. Store adhesive between 60 degrees Fahrenheit (°F) (15 degrees Celsius [°C]) and 80 °F (26 °C).
- F. Do not use materials damaged during storage or handling. Do not use adhesive exposed to temperatures of 40 °F (4 °C) for more than 24 hours.

1.9 ENVIRONMENTAL REQUIREMENTS

- A. Product Requirements: environmental conditions affecting products on site.
- B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, wetland areas, vegetation and landscape in immediate or adjacent areas.

1.10 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.
- B. Verify field measurements before cutting panels

1.11 WARRANTY

- A. Execution Requirements: Requirements for warranties
- B. Furnish (1-year) manufacturer's warranty for repair or replacement of liners that leak or fail in materials and workmanship or that deteriorate under conditions of normal weather and sun exposure. Warranty does not include deterioration or failure of liner due to exposure to harmful chemicals, gases

or vapors, abnormal and severe weather phenomena, fire, earthquakes, floods, vandalism, or abuse by persons, animals, or equipment.

PART 2 PRODUCTS

2.1 POLYVINYL CHLORIDE (PVC) LINER (GEOMEMBRANE)

A. Furnish 30-mil materials in accordance with the following specified values and as approved by the QC/Engineer

B. Materials:

<u>Property</u>	<u>Test Method</u>	<u>Specified Values</u>
Thickness mils (Nominal .5%)	ASTM D 1593	30
Specific Gravity, min.	ASTM D 792	1.23
Tensile Strength, psi, min. (Breaking Factor, lbs./in. width, min.)	ASTM D 882	2300 69
Elongation, at Break, % min.	ASTM D 882	350
Modulus at 110%	ASTM D 882	1000
Elongation, psi, min. (lbs./in. width min.)		30
Tear Resistance, lbs./in. min. (lbs., min.)	ASTM D 1004	300 9
Low Temperature, °F	ASTM D 1790	-20
Dimensional Stability at 212°F for 15 min. % change, max.	ASTM D 1204	3.5 -29
Water Extraction % loss, max.	ASTM D 3083	0.25
Volatility % loss, max.	ASTM D 1203	0.70
Resistance to Soil Burial % change, max.	ASTM D 3038	
Tensile Strength		-5
Elongation, at Break		-20
Modulus at 100%		+20
Elongation		

Hydrostatic Resistance, psi min.	ASTM D 751	85
Factory Seam Requirements Bonded Seam Strength Modified (factory seam, breaking factor, lbs./in. width)	ASTM D 3083	55
* Factory bonded seam strength is the responsibility of the fabricator.		

2.2 ALTERNATE LINER 30 MIL/40 MIL HDPE

A. In accordance with the following specification valves and as approved by the QC/Engineer.

B. Materials		
<u>Property</u>	<u>Test Method</u>	<u>Specified Values</u>
Minimum thickness (mil)	ASTM D 751, D 1593 or D 5199	27
Density (g/cm ³)	ASTM D 792 (B) or D 1505	0.940
Carbon black content (%)	ASTM D 1603, modified	2.0
Carbon black dispersion	ASTM D 3015	A2
Tensile properties (each direction):	ASTM D 638 Type IV, 2 ipm	
Strength at yield (lb/in)	NSF 54 modified	65
Strength at break (lb/in)		122
Elongation at yield (%)	(1.3" gauge length)	13
Elongation at break (%)	2.5" gauge length	560
Tear resistance (lb)	ASTM D 1004	22
Puncture resistance (lb)	FTMS 101, Method 2065	39
ESCR (hours)	ASTM D 1693 B)	1,500
Dimensional stability (% change)	ASTM D 1204 (1 hr. at 100°C)	± 2

2.3 GEOTEXTILE

- A. Furnish a 16-ounce non-woven geotextile materials in accordance ASTM standards-grab tensile strength D 4632 - 400 lb, puncture strength D 4833 - 250 lb.

2.4 GEONET DRAINAGE LAYER

- A. Furnish a geocomposite fabric net with 8-ounce non-woven geotextile bonded to both sides of a high-density polyethylene (HDPE) net (GSE FabriNet - Gundle Lining or approved equal).

2.5 ACCESSORIES

- A. Adhesives and solvents: types recommended by liner manufacturer for bonding to structures, for sealing seams in geomembrane, and for sealing projections through liner.
- B. Penetration assemblies: manufacturer's standard factory-fabricated pipe-boots for sealing penetrations for utilities.
- C. Stainless steel SS306 batten bar with ½-inch Red Head anchor bolts shall be used as needed to attach to concrete structures (pre-cast sump box catch basin inlet).

2.6 FABRICATION

- A. Fabricate Geomembrane liner panels from sheets in sizes as large as possible with factory-sealed seams, consistent with limitations of weight and installation procedures. Minimize field seaming with liner panel layout as shown in the drawing or per approved liner layout.
- B. 10-inch PVC pipe boots with stainless steel bands for penetration through cofferdam liner.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Administrative requirements: verification of existing conditions before starting work.
- B. Verify anchor trench excavation, where liner is to be secured, is in correct location and configuration.
- C. Verify subgrade and anchor trench excavation is free from angular rocks, rubble, roots, vegetation, debris, voids, protrusions, and ground water; and other conditions affecting performance of liner.

3.2 PREPARATION

- A. Prepare base and slopes to receive Geomembrane liner in accordance with the QC/Engineers approval. Shape slopes and bottom to even surface and to required inverts (depth) and section as indicated on drawings and according to liner manufacturer's instructions.
- B. Verify subbase preparation Section 02300 - Earthwork. Scarify the top 6-inches of sub-base.
- C. Re-inspect sub-base and remove sharp sticks, stones and trash from the scarified top 6 inches of excavation sub-base that may puncture liner.
- D. Recompact any disturbed sub-base to 90 percent relative compaction per approval of the QC/Engineer.
- E. Finish grade the sub-base smooth to the approval of the liner manufacturers' representative and the QC/Engineer for the installation of the liner material
- F. Prepare perimeter-anchoring trench as indicated on drawings.

3.3 INSTALLATION

- A. Position liner on berm so one edge can be buried in anchoring trench before remainder is opened down the slope and across the base area.
- B. Stretch liner to its full width along entire length of liner.
- C. When field jointing of sections is required, position second section adjacent to first section and unfold so edges to be joined are overlapped minimum of 6 inches. Panel joints shall be as shown on the drawing or by a liner layout plan approved by the Engineer. No field seams will be allowed on the cofferdam system, except for a 10-inch PVC pipe boot, which shall be in accordance with manufacturer's instructions.
- D. If field seaming is needed, fold back liner edge to be field-seamed. Place and spread a two-inch bentonite clay layer under the liner edge to be field-seamed.
- E. Clean seam area of dust, dirt and moisture.
- F. Smooth out wrinkles and air spaces.
- G. Seal seam with bonding solvent adhesive or heat seam in accordance with manufacturer's instructions.
- H. Seal liner to concrete structures and pipe projections through liner as indicated on drawings and in accordance with liner

manufacturer's instructions. Place and spread a 2-inch bentonite clay soil material under the liner before liner attachment or sealing to structures or pipe penetration through the liner.

- I. Tightly bond and seal liner joints on completion of liner installation.
- J. Place Geotextile liner over the PVC liner along the edge and on berm, so one edge can be buried in anchoring trench before remainder is opened in the stockpile area or down the slope into the detention basin as shown in the drawing details.
- K. Replace or repair liner surfaces showing injury due to scuffing, penetration by sharp objects, or distress from rough subgrade as directed by QC/Engineer.
 - 1. Repair liner by covering damaged area with additional layer of liner material to conceal and extend minimum 12 inches beyond damaged area.

3.4 FIELD QUALITY CONTROL

- A. Quality requirements: field inspecting and testing with air lance and pull test seams per manufacturer's procedures.
- B. Before initial placement of earth or other cover or filling of basin, inspect seams and repaired areas to ensure tight, continuously bonded installation. Repair damaged liner and seams and re-inspect repaired work.

3.5 PROTECTION OF FINISHED WORK

- A. Section 01450 - Quality Control requirements: Requirements for final inspection and protecting finished Work.
- B. Protect installed liner according to liner manufacturer's instructions. Repair or replace areas of liner damaged by scuffing, punctures, traffic, rough subgrade, or other unacceptable conditions.

-- End of Section --

SECTION 02930
VEGETATION

This specification will be provided as an attachment to the Site Restoration Plan, which will be prepared upon completion of field mapping survey.

-- End of Section --

APPENDIX K

SITE PHOTOGRAPHS

**APPENDIX K
DRAFT FINAL
SITE PHOTOGRAPHS**

FOR

**SITE 27
FORMER NAVAL AIR STATION MOFFETT FIELD,
SANTA CLARA COUNTY, CALIFORNIA**

**ENVIRONMENTAL MULTIPLE AWARD CONTRACT
Contract Number N68711-04-D-1105
Contract Task Order 0002**

January 13, 2006

Prepared for



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APPENDIX K

SITE PHOTOS



Photo 1 - Northern Channel



Photo 2 - Northern Channel

APPENDIX K

SITE PHOTOS



Photo 3 - Marriage Road Ditch

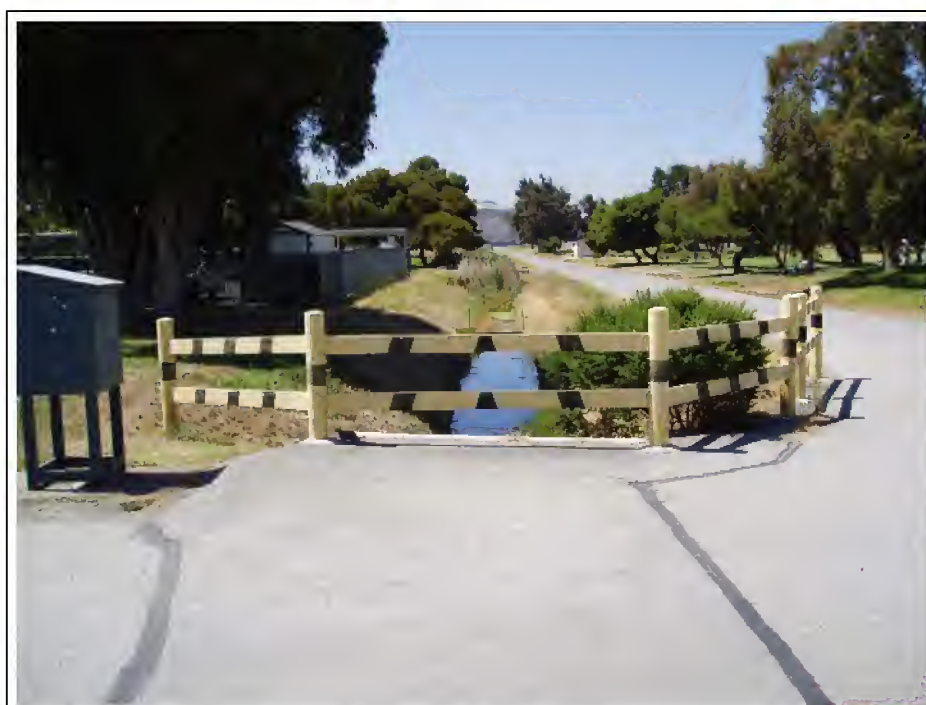


Photo 4 - Marriage Road Ditch

APPENDIX K

SITE PHOTOS



Photo 5 - Marriage Road Ditch



Photo 6 - Marriage Road Ditch

APPENDIX K

SITE PHOTOS

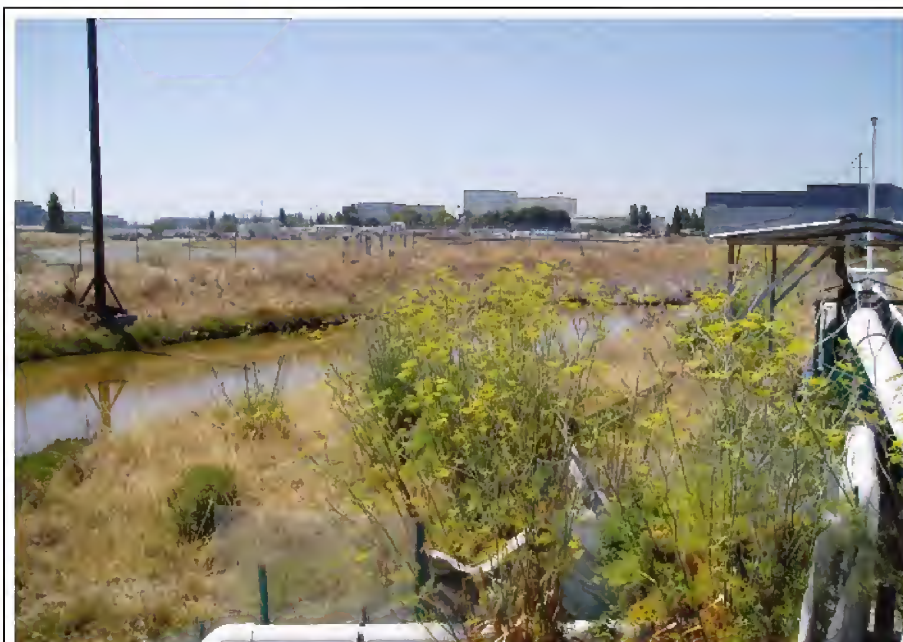


Photo 7 - North Patrol Road Ditch



Photo 8 - North Patrol Road Ditch

ATTACHMENT 1

**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
FOR THE NORTHERN CHANNEL**

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or relevant and appropriate requirement
CCR	<i>California Code of Regulations</i>
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	<i>Code of Federal Regulations</i>
EPA	U.S. Environmental Protection Agency
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PCB	Polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
USC	<i>United States Code</i>

C1 INTRODUCTION

This appendix sets forth the applicable or relevant and appropriate requirements (ARAR) for this Record of Decision for Site 27, which consists of the Northern Channel and related areas, at former Naval Air Station Moffett Field.

C1.1 SUMMARY OF COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT AND NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN REQUIREMENTS

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (Title 42 *United States Code* Section 9621[d]), as amended, states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site (U.S. Environmental Protection Agency [EPA] 1988a). A requirement must be determined to be both relevant and appropriate in order to be considered an ARAR.

The criteria for determining relevance and appropriateness are listed in Title 40 *Code of Federal Regulations* (CFR) Section 300.400(g)(2), and include the following:

- The purpose of the requirement and the purpose of the CERCLA action
- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site
- The substances regulated by the requirement and the substances found at the CERCLA site

- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site
- The type of place regulated and the type of place affected by the release or CERCLA action
- The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action
- Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site

According to CERCLA ARARs guidance (EPA 1988a), a requirement may be "applicable" or "relevant and appropriate," but not both. Identification of ARARs must be done on a site-specific basis and involve a two-part analysis: first, a determination whether a given requirement is applicable; then, if it is not applicable, a determination whether it is nevertheless both relevant and appropriate. It is important to explain that some regulations may be applicable or, if not applicable, may still be relevant and appropriate. When the analysis determines that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable (EPA 1988b).

Tables included in this appendix present each potential ARAR with a determination of status (that is, applicable or relevant and appropriate). For the determination of relevance and appropriateness, the pertinent criteria were examined to determine whether the requirements addressed problems or situations sufficiently similar to the circumstances of the release or response action contemplated, and whether the requirement was well suited to the site.

To qualify as a state ARAR under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a state requirement must be:

- A state law
- An environmental or facility siting law
- Promulgated (of general applicability and legally enforceable)
- Substantive (not procedural or administrative)
- More stringent than the federal requirement
- Identified in a timely manner
- Consistently applied

To constitute an ARAR, a requirement must be substantive. Therefore, only the substantive provisions of requirements identified as ARARs in this analysis are considered to be ARARs. Permits are considered to be procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or nonenvironmental, including permit requirements, are not considered to be ARARs. CERCLA Section 121(e)(1) (Title 42 *United States Code* Section 9621[e][1]), states that, "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." The term "on site" is defined for purposes of this ARARs discussion as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (Title 40 CFR Section 300.5).

Nonpromulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. Such requirements may, however, be useful, and are "to be considered". To be considered (Title 40 CFR Section 300.400[g][3]) requirements complement ARARs but do not override them. They are useful for guiding decisions on cleanup goals or methodologies when regulatory standards are not available.

Pursuant to EPA guidance (EPA 1988a), ARARs are generally divided into three categories: chemical-specific, location-specific, and action-specific requirements. This classification was developed to aid in the identification of ARARs; some ARARs do not fall precisely into one group or another. ARARs are identified on a site basis for remedial actions where CERCLA authority is the basis for cleanup.

As the lead federal agency, the Navy has primary responsibility for identifying federal ARARs at former Naval Air Station Moffett Field. Federal ARARs have been identified for Site 27 in this Record of Decision and are discussed in this appendix. Pursuant to the definition of the term "on site" in Title 40 CFR Section 300.5, the following are considered on-site property for this ARARs analysis:

- Northern Channel
- Marriage Road Ditch
- Patrol Road Ditch
- North Patrol Road Ditch
- Debris Pile (the debris pile is located north of the Building 191 lift station at the western end of the Northern Channel)
- Berms (the Cargill and National Aeronautics and Space Administration berms adjacent to Building 191, and the Lockheed Martin Corporation berm near the eastern end of the Northern Channel)

Identification of potential state ARARs was initiated through Navy requests to the San Francisco Bay Regional Water Quality Control Board (Water Board). The state identification process is described in more detail in Section C1.2.3. State ARARs that have been identified for Site 27 are discussed in this appendix.

C1.2 METHODOLOGY DESCRIPTION

This section describes the process of identifying and evaluating federal and state ARARs.

C1.2.1 General

As the lead federal agency, the Navy has primary responsibility for identification of ARARs for the Northern Channel and related areas. In preparing this ARARs analysis, the Navy undertook the following measures, consistent with CERCLA and the NCP:

- Identified federal ARARs for each remedial alternative addressed in the feasibility study report taking into account site-specific information for Site 27
- Reviewed potential state ARARs identified by the state to determine whether they satisfy CERCLA and NCP criteria that must be met in order to constitute state ARARs
- Evaluated and compared federal ARARs and their state counterparts to determine whether state ARARs are more stringent than the federal ARARs or are in addition to the federally required actions
- Reached a conclusion as to which federal and state ARARs are the most stringent and/or "controlling" ARARs for each alternative

As outlined in Section 8.0 of the ROD, the remedial action objective for sediment in the Northern Channel and related areas is as follows:

Reduce the direct exposure of ecological receptors to total polychlorinated biphenyls (PCB), pesticides (total dichlorodiphenyltrichloroethane and total chlordane), and metals in sediment to levels that are protective of upper-trophic-level receptors in the Northern Channel and related areas. By protecting these receptors, lower-trophic-level receptors such as benthic invertebrates as well as human health also will be protected in the Northern Channel and related areas.

To meet the remedial action objective, the proposed remediation areas comprise any part of the Northern Channel and related areas with concentrations greater than:

- Total Polychlorinated Biphenyls: 0.35 milligrams per kilogram (or 350 micrograms per kilogram)
- Total Dichlorodiphenyltrichloroethane: 0.0648 milligrams per kilogram (or 64.8 micrograms per kilogram)
- Total Chlordane: 0.931 milligrams per kilogram (or 931 micrograms per kilogram)
- Cadmium: 184 milligrams per kilogram
- Lead: 173 milligrams per kilogram
- Mercury: 1.52 milligrams per kilogram
- Selenium: 0.926 milligrams per kilogram
- Silver: 13.7 milligrams per kilogram
- Zinc: 720 milligrams per kilogram

The Navy is addressing total dichlorodiphenyltrichloroethane and total chlordane as part of the selected remedy at Site 27 because these chemicals are the result of runoff from other areas. The concentrations above correspond to protective cleanup goals for upper-trophic-level receptors that were based on birds.

Additionally, residential preliminary remediation goals were identified as cleanup goals for soil in the berms for each chemical below (U.S. Environmental Protection Agencies 2004).

- Total Polychlorinated Biphenyls: 0.22 milligrams per kilogram (or 220 micrograms per kilogram)
- Dichlorodiphenyldichloroethane: 2.4 milligrams per kilogram (or 2,400 micrograms per kilogram); dichlorodiphenyldichloroethene: 1.7 mg/kg (or 1,700 micrograms per kilogram); dichlorodiphenyltrichloroethane: 1.7 mg/kg (or 1,700 micrograms per kilogram)
- Total Chlordane: 1.6 milligrams per kilogram (or 1,600 micrograms per kilogram)
- Cadmium: 37 milligrams per kilogram
- Lead: 150 milligrams per kilogram (California-modified preliminary remediation goal)
- Mercury: 23 milligrams per kilogram
- Selenium: 390 milligrams per kilogram
- Silver: 390 milligrams per kilogram
- Zinc: 23,000 milligrams per kilogram

Six remedial alternatives were developed in the feasibility study report to address potential ecological risks in Site 27 (Tetra Tech EM Inc. 2003). The alternatives included no action, excavation and disposal off site, excavation and ex situ treatment of contaminated sediment, and capping. Ex situ treatment technologies include bioremediation and solidification. The Navy selected excavation and off-site disposal as the remedial action for the Northern Channel and related areas.

C1.2.2 Identifying and Evaluating Federal Applicable or Relevant and Appropriate Requirements

The federal government implements a number of environmental statutes that are the source of potential federal ARARs, either in the form of the statutes themselves or as regulations promulgated thereunder. Examples include the Resource Conservation and Recovery Act (RCRA), the Clean Water Act, the Safe Drinking Water Act, the Toxic Substances Control Act, and their implementing regulations, to name a few. See NCP preamble at Title 55 *Federal Register* 8764–8765 (1990) for a more complete listing.

The proposed remedial alternatives were reviewed against all potential ARARs, including but not limited to those set forth at Title 55 *Federal Register* 8764–8765 (1990), to determine if they were applicable or relevant and appropriate, using CERCLA and NCP criteria and procedures for ARARs identification by lead federal agencies.

C1.2.3 Identifying and Evaluating State Applicable or Relevant and Appropriate Requirements

This section describes the process of identifying and evaluating potential state ARARs by the state and the Navy.

C1.2.3.1 Solicitation of State ARARs under NCP

EPA guidance recommends that the lead federal agency consult with the state when identifying state ARARs for remedial actions (EPA 1988b). In essence, the CERCLA and NCP requirements in Title 40 CFR Section 300.515 for remedial actions provide that the lead federal agency request that the state identify chemical- and location-specific state ARARs when site characterization is complete. The requirements also provide that the lead federal agency request identification of all categories of state ARARs (chemical-, location-, and action-specific) upon completion of identification of remedial alternatives that have been retained for detailed analysis. The state must respond within 30 days of receipt of the lead federal agency requests. The remainder of this subsection documents the Navy's efforts to date to identify and evaluate state ARARs.

The Navy followed the procedures of the process set forth in Title 40 CFR Section 300.515 and Section 9.6 of the Federal Facility Agreement for remedial actions in seeking state assistance in identifying state ARARs.

C1.2.3.2 Chronology of Efforts to Identify State ARARs

The Navy formally requested state chemical-, location-, and action-specific ARARs for Site 27 in a letter submitted on January 17, 2001. The letter was sent to the Water Board soliciting ARARs based on preliminary remedial technologies and process options considered by the Navy.

On February 28, 2001, the Navy received a response from the Water Board with a list of potential chemical-, location-, and action-specific ARARs that the Water Board believes are applicable or relevant and appropriate. The Navy evaluated the Water Board's response to assess whether any of the laws and regulations cited satisfied the CERCLA and NCP criteria required to be considered state ARARs. The Navy then included any potential state ARARs in the FS. In this Record of Decision, the Navy is selecting the ARARs, including state ARARs, that are appropriate for its remedial action decision. Key correspondence between the Navy and the state agencies relating to this effort is included in the Administrative Record, Appendix A, for this Record of Decision.

C1.3 OTHER GENERAL ISSUES

This section discusses general issues identified during the evaluation of ARARs for the Northern Channel and related areas.

C1.3.1 General Approach to Requirements of the Federal Resource Conservation and Recovery Act

RCRA is a federal statute passed in 1976 to meet four goals: the protection of human health and the environment, the reduction of waste, the conservation of energy and natural resources, and the elimination of the generation of hazardous waste as expeditiously as possible. The Hazardous and Solid Waste Amendments of 1984 significantly expanded the scope of RCRA by adding new corrective action requirements, land disposal restrictions, and technical requirements. RCRA, as amended, contains several provisions that are potential ARARs for CERCLA sites.

Substantive RCRA requirements are applicable to response actions on CERCLA sites if the waste is an RCRA hazardous waste, and either:

- The waste was initially treated, stored, or disposed of after the effective date of the particular RCRA requirement; or
- The activity at the CERCLA site constitutes treatment, storage, or disposal, as defined by RCRA (EPA 1988a).

The preamble to the NCP indicates that state regulations that are components of a federally authorized or delegated state program are generally considered federal requirements and

potential federal ARARs for the purposes of the ARARs analysis (Title 55 *Federal Register* Sections 8666, 8742 [1990]). The state of California received approval for its base RCRA hazardous waste management program on July 23, 1992 (Title 57 *Federal Register* Section 32726 [1992]). The state of California "Environmental Health Standards for the Management of Hazardous Waste," set forth in Title 22 *California Code of Regulations* (CCR) Division 4.5, were approved by EPA as a component of the federally authorized state of California RCRA program.

The regulations of Title 22 CCR Division 4.5 are, therefore, a source of potential federal ARARs for CERCLA response actions. The exception is when a state regulation is "broader in scope" than the corresponding federal RCRA regulations. In that case, such regulations are not considered part of the federally authorized program or potential federal ARARs. Instead, they are purely state law requirements and therefore are potential state ARARs.

The EPA July 23, 1992, notice approving the state of California RCRA program (Title 57 *Federal Register* Section 32726 [1992]) specifically indicated that the state regulations addressed certain non-RCRA, state-regulated hazardous wastes that fell outside the scope of federal RCRA requirements. Title 22 CCR Division 4.5 requirements would be potential state ARARs for such non-RCRA, state-regulated wastes.

C1.4 WASTE CHARACTERIZATION

This section describes the selection of ARARs involving characterization of wastes.

C1.4.1 Resource Conservation and Recovery Act Hazardous Waste Determination

A federal RCRA hazardous waste determination is necessary to determine whether RCRA requirements at Title 22 CCR Division 4.5 and other state requirements at Title 23 CCR Division 3, Chapter 15 are applicable. The first step in the RCRA hazardous waste characterization process is to evaluate the contaminated media at the site and determine whether it constitutes a "listed" RCRA waste. The preamble to the NCP states that "...it is often necessary to know the origin of the waste to determine whether it is a listed waste and that, if such documentation is lacking, the lead agency may assume it is not a listed waste" (Title 55 *Federal Register* Section 8666, 8758 [1990]).

This approach is confirmed in EPA guidance for CERCLA compliance with other laws (EPA 1989), as follows:

"To determine whether a waste is a listed waste under RCRA, it is often necessary to know the source. However, at many Superfund sites, no information exists on the source of wastes. The lead agency should use available site information, manifests, storage records, and vouchers in an effort to ascertain the nature of these contaminants. When this documentation is not available, the lead agency

may assume that the wastes are not listed RCRA hazardous wastes, unless further analysis or information becomes available that allows the lead agency to determine that the wastes are listed RCRA hazardous wastes."

Based on the available information, it is not possible to determine the source of the contaminants in the sediment for RCRA-listed waste purposes. Therefore, the Navy has made the determination that the presence of PCBs, pesticides, and metals should not necessarily cause contaminated sediment to be classified as RCRA-listed hazardous wastes. By extension of this reasoning, the residuals generated during treatment of the contaminated sediment will not be classified as RCRA-listed hazardous wastes either.

The second step in the RCRA hazardous waste characterization process is to evaluate potential hazardous characteristics of the waste. The evaluation of characteristic waste is described in EPA guidance as follows (EPA 1988a):

"Under certain circumstances, although no historical information exists about the waste, it may be possible to identify the waste as RCRA characteristic waste. This is important in the event that (1) remedial alternatives under consideration at the site involve on-site treatment, storage, or disposal, in which case RCRA may be triggered as discussed in this section; or (2) a remedial alternative involves off-site shipment. Since the generator (in this case, the agency or responsible party conducting the Superfund action) is responsible for determining whether the wastes exhibit any of these characteristics (defined in 22 CCR Sections 66261.21-66261.24), testing may be required. The lead agency must use best professional judgment to determine, on a site-specific basis, if testing for hazardous characteristics is necessary.

In determining whether to test for the toxicity characteristic using the extraction procedures (EP) toxicity test, it may be possible to assume that certain low concentrations of waste are not toxic. For example, if the total waste concentration in soil is 20 times or less the EP toxicity concentration, the waste cannot be characteristic hazardous waste. In such a case, RCRA requirements would not be applicable. In other instances, where it appears that the substances may be characteristic hazardous waste (ignitable, corrosive, reactive, or EP toxic), testing should be performed."

Hazardous waste characteristics, as defined in Title 40 CFR Sections 261.21-261.24, are commonly referred to as ignitability, corrosivity, reactivity, and toxicity. California environmental health standards for the management of hazardous waste set forth in Title 22 CCR Division 4.5 were approved by EPA as a component of the federally authorized California RCRA program. Therefore, the characterization of RCRA waste is based on the state requirements.

According to Title 22 CCR Section 66261.10, waste characteristics can be measured by an available standardized test method or be reasonably detected by generators of waste based on their knowledge of the waste. Sediment contamination in the Northern Channel and related areas is not ignitable, corrosive, or reactive, as defined in Title 22 CCR Sections 66261.21–66261.23. This determination was based on knowledge of the nature and concentrations of contaminants and on professional judgment.

The requirements at Title 22 CCR Section 66261.24(a)(1) list the toxic contaminant concentrations that determine the characteristic of toxicity. Sediment excavated from the Northern Channel and related areas will be sampled and analyzed to determine if it is toxic. Therefore, the Navy has selected Title 22 CCR Section 66261.24(a)(1) as an ARAR.

C1.4.2 Toxic Substances Control Act Requirements for Waste Characterization

Sampling and analysis is necessary to determine whether soil and sediment that contains PCBs is subject to the federal Toxic Substances Control Act requirements at Title 40 CFR Section 761.61. Under Section 761.3 of Title 40 CFR “PCB remediation waste” is defined as waste that contains PCBs as a result of a spill, release, or other unauthorized disposal, at the following concentrations: Material disposed of before April 18, 1978, that currently contains a concentration of 50 parts per million (or 50 milligrams per kilogram) PCBs, regardless of the concentration of the original spill; materials that are currently at any volume or concentration where the original source was 500 parts per million (or 500 milligrams per kilogram) of PCBs beginning on April 18, 1978, or 50 parts per million or (50 milligrams per kilogram) beginning on July 2, 1979; and materials that are currently at any concentration if the PCBs are spilled or released from a source that is not authorized for use under this part. PCB remediation waste means soil, rags, and other debris generated as a result of PCB spill cleanup.

The Navy determined that Title 40 CFR Section 761.61(a)(4)(i) is an ARAR. Concentrations of PCBs in excavated sediment will be measured to comply with the substantive requirements of Title 40 Section CFR 761.61(a)(4)(i). Based on TSCA, the cleanup goal for sediment would be 25 milligrams per kilogram because the Northern Channel and related areas are low-occupancy areas. As explained in Section C2, under TSCA 40 CFR 761.61(a)(4)(vi), more stringent cleanup goals may be required based on the proximity to areas such as endangered species habitats, estuaries, and wetlands. Based on the results of the ecological risk assessment conducted for the site, a lower cleanup goal was selected. The cleanup goal is 350 micrograms per kilogram (or 0.35 milligram per kilogram) for total PCBs.

C1.4.3 California-Regulated, Non-Resource Conservation and Recovery Act Hazardous Waste

A waste determined not to be an RCRA hazardous waste may still be considered a state-regulated, non-RCRA hazardous waste. The state is broader in scope in its RCRA program in determining hazardous waste. Title 22 CCR Section 66261.24(a)(2) lists the total threshold limit concentrations and the soluble threshold limit concentrations for non-RCRA hazardous waste. A

waste is considered hazardous if its total concentrations exceed the total threshold limit concentrations or if the extract from the waste extraction test is equal to or greater than the soluble threshold limit concentration. A waste extraction test is required only when the total concentrations exceed the soluble threshold limit concentration but are less than the total threshold limit concentrations (Title 22 CCR Division 4.5, Chapter 11, Appendix II [b]). The Navy determined that Title 22 CCR Section 66261.24(a)(2) is an ARAR. The excavated sediment will be characterized to determine if it is state regulated, non-RCRA hazardous waste.

C1.4.4 Other California Waste Classifications

For waste discharged after July 18, 1997, solid waste classifications at Title 27 CCR Sections 20210, 20220, and 20230 are used to determine the applicability of waste management requirements. These classifications are summarized below.

A "designated waste" under Title 27 CCR Section 20210 is defined at *California Water Code* Section 13173. Under *California Water Code* Section 13173, designated waste is hazardous waste that has been granted a variance from hazardous waste management requirements. Designated waste also may be nonhazardous waste that consists of or contains pollutants that, under ambient environmental conditions at a waste management unit, could be released in concentrations that would exceed applicable water quality objectives or that could reasonably be expected to affect beneficial uses of the waters of the state. The Navy determined that Title 27 CCR Section 20210 is an ARAR.

A nonhazardous solid waste under Title 27 CCR Section 20220 is all putrescible and nonputrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, manure, vegetable or animal solid and semisolid wastes, and other discarded waste (whether of solid or semisolid consistency) provided that such wastes do not contain wastes that must be managed as hazardous wastes or wastes that contain soluble pollutants in concentrations that exceed applicable water quality objectives or could cause degradation of waters of the state. The Navy determined that Title 27 CCR Section 20220 is an ARAR.

Under Title 27 CCR Section 20230, inert waste is a subset of solid waste that does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable water quality objectives and does not contain significant quantities of decomposable waste. Sediments from the Northern Channel and related areas that are not identified as hazardous will be characterized using these criteria to identify the appropriate disposal requirements. The Navy determined that Title 27 CCR Section 20230 is an ARAR.

C2 CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Chemical-specific applicable or relevant and appropriate requirement (ARAR) are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in the establishment of a cleanup goal. Many potential ARARs associated with particular response alternatives (such as closure or discharge) can be characterized as action-specific but include numerical values or methodologies to establish them so they fit in both categories (chemical- and action-specific).

This section presents federal and state chemical-specific ARARs determination conclusions for sediment in the Northern Channel and related areas (Table C-1). Toxic Substances Control Act is the only federal chemical-specific ARAR for sediments. For soil in the berms and debris pile, the Navy and the U.S. Environmental Protection Agency have agreed to use the residential preliminary remediation goal as the cleanup goal for PCBs and other chemicals of ecological concern in soil. There are no state chemical-specific ARARs for polychlorinated biphenyls (PCB) in sediment. However, the Navy has determined that the certain substantive requirements of Chapter 2 of the Water Quality Control Plan (hereinafter referred to as the "Basin Plan") for the San Francisco Bay Regional Water Quality Control Board (1995) are ARARs.

Sediment is the environmental medium potentially affected by the response actions for the Northern Channel and related areas. The conclusions for ARARs pertaining to this medium are presented in the following sections.

SEDIMENT APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Federal

The federal chemical-specific ARARs for PCBs are in regulations adopted pursuant to Toxic Substances Control Act. Toxic Substances Control Act regulates storage and disposal of PCBs. U.S. Environmental Protection Agency designed self-implementing procedures for a general, moderate-size site where residual environmental impact from remedial actions should be low. The requirements at Title 40 *Code of Federal Regulations* (CFR) Section 761.61(a) are not binding for response actions under Comprehensive Environmental Response, Compensation, and Liability Act (Title 40 CFR Section 761.61[a][1][ii]) and are therefore not applicable requirements. However, the substantive cleanup goals at Title 40 CFR Section 761.61(a)(4) may be relevant and appropriate for soil response actions. Under Title 40 CFR Section 761.61(a)(4)(i)(A), the cleanup goal for bulk PCB remediation waste in high-occupancy areas is less than or equal to 1 parts per million (or 1 milligram per kilogram) without further conditions. The cleanup goal for bulk PCB remediation waste in low-occupancy areas is less than or equal to 25 parts per million (or 25 milligrams per kilogram) under Title 40 CFR Section 761.61(a)(4)(i)(B)(1).

TABLE C-1: FEDERAL AND STATE CHEMICAL-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Record of Decision, Site 27 – Northern Channel, Former Naval Air Station Moffett Field, California

Requirement	Prerequisite	Citation	Applicable or Relevant and Appropriate Requirement Determination ^a	Comments
Federal Requirements				
Toxic Substances Control Act (Title 15 United States Code, Chapter 53, Sections 2601-2692)				
Regulates storage and disposal of PCBs	Soil, debris, sludge or dredged materials contaminated with PCBs.	PCB remediation waste cleanup standards, Title 40 Code of Federal Regulations Section 761.61 (a)(4)(i)	Relevant and Appropriate	The cleanup goal for bulk remediation waste in high occupancy areas is less than or equal to 1 part per million (or 1 milligram per kilogram) without further conditions. The cleanup goal for bulk PCB remediation waste in low-occupancy areas is less than or equal to 25 mg/kg. Under TSCA 40 CFR 761.61(a)(4)(vi), more stringent cleanup goals may be required based on the proximity to areas such as endangered species habitats, estuaries, and wetlands. Based on the results of the ecological risk assessment conducted for this site, a lower cleanup goal was selected. The cleanup goal is 350 micrograms per kilogram (or 0.35 milligram per kilogram) for total PCBs. The Navy and the U.S. Environmental Protection Agency have agreed to use the residential preliminary remediation goal as the cleanup goal for PCBs and other chemicals of ecological concern in soil.
State Requirements				
State and Regional Water Quality Control Boards				
Describes water basins and establishes beneficial uses	Impact to groundwater.	Water Quality Control Plan for the San Francisco Bay Region (Basin Plan) (Water Code Section 13240)	Applicable	The substantive requirements of the following provisions of Chapter 2 of the Basin Plan are applicable requirements: "Definitions of Beneficial Uses," "Present and Potential Beneficial Uses, Surface Waters," and "the Santa Clara Valley Basin section of Table 2-9."

Notes:

a Indicates whether the requirement is applicable or relevant and appropriate for Alternatives 2 through 5.

PCB Polychlorinated biphenyl

Source:

San Francisco Bay Regional Water Quality Control Board. 1995. "Water Quality Control Plan, San Francisco Bay Basin, Region 2." December.

Under Section 761.3 of Title 40 CFR, "PCB remediation waste" is defined as waste that contains PCBs as a result of a spill, release, or other unauthorized disposal, at the following concentrations: materials disposed of before April 18, 1978, that are currently at concentrations of 50 parts per million (or 50 milligrams per kilogram) of PCBs, regardless of the concentration of the original spill; materials that are currently at any volume or concentration where the original source was 500 parts per million of PCBs beginning on April 18, 1978, or 50 parts per million (or 50 milligrams per kilogram) of PCBs beginning on July 2, 1979; and materials that are currently at any concentration if PCBs are spilled or released from a source not authorized for use under this part. PCB remediation waste means soil, rags, and other debris generated as a result of any PCB spill cleanup. "High occupancy" areas are areas such as residences, schools, and day-care centers where people spend at least 16.8 hours a week. "Low occupancy" areas are areas such as electrical substations or locations in an industrial facility where a worker spends small amounts of time, which is less than 7 hours per week. Although these regulations may not be applicable because current concentrations are less than 50 parts per million (or 50 milligrams per kilogram) and the concentrations of the original spill are unknown, the Navy has nevertheless concluded that these regulations are relevant and appropriate because similar substances are found at the site.

Based on TSCA, the cleanup goal for sediment would be 25 milligrams per kilogram because the Northern Channel and related areas are low-occupancy areas. However, according to TSCA 40 CFR 761.61(a)(4)(vi), more stringent cleanup goals may be required based on the proximity to areas such as endangered species habitats, estuaries, and wetlands. The cleanup goal of 25 parts per million (or 25 milligrams per kilogram) is not sufficiently protective of ecological receptors at Site 27. The feasibility study for Site 27 explains that the identified allowable exposure level range is 350 to 8,610 micrograms per kilogram (or 0.35 to 8.6 milligrams per kilogram) (Tetra Tech EM Inc. 2003). This allowable exposure level range is based on risks to the Black-necked Stilt because it is the most conservative allowable exposure level when comparing the three birds. The site-specific allowable exposure level range of 350 to 8,610 micrograms per kilogram (or 0.35 to 8.6 milligrams per kilogram) is recommended as the remedial action objective range for total Aroclors for the Northern Channel and related areas. Therefore based on the results of the ecological risk assessment, the cleanup goal is 350 micrograms per kilogram (or 0.35 milligram per kilogram) for total PCBs.

State

There is no state chemical-specific ARAR for PCBs. However, PCBs may be regulated as hazardous waste under the Hazardous Waste Control Law. These requirements for characterizing and handling are discussed under the action-specific requirements.

The substantive provisions of the following sections of the Basin Plan are ARARs:

- Definitions of beneficial uses
- Present and potential beneficial uses, surface waters
- The Santa Clara Valley Basin section of Table 2-9 in the Basin Plan

C3 LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

This section identifies and discusses the location-specific applicable or relevant and appropriate requirements (ARAR). The discussions are presented based on various attributes of the site location.

Biological resources, coastal resources, hydrological resources, and wetlands protection are the resource categories relating to location-specific requirements potentially affected by the response actions at the Northern Channel and related areas. The conclusions for ARARs pertaining to these resources are presented in the following sections. Table C-2 presents and evaluates federal and state location-specific ARARs for excavation of contaminated sediments.

C3.1 BIOLOGICAL RESOURCES APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Both federal and state laws and regulations prohibit the taking of endangered and threatened plant and animal species and their critical habitat. The Northern Channel and related areas are not critical habitat for endangered or threatened species, as defined in Title 50 *Code of Federal Regulations* (CFR) Part 17, Subpart B, Sections 17.11 and 17.12. Although they have never been observed in the area, both federal and state endangered species may visit (for example, the California brown pelican, American peregrine falcon, and California least tern) or reside (for example, the California clapper rail and salt marsh harvest mouse) within the Northern Channel and related areas.

C3.1.1 Federal

Endangered Species Act of 1973

The Endangered Species Act of 1973 (Title 16 *United State Code* [USC] Sections 1531-1543) provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction. The Endangered Species Act defines an endangered species and provides for designation of critical habitats. Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. Under Section 7(a) of the Endangered Species Act, federal agencies must carry out conservation programs for listed species. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented. The requirement of Section 7(a) for federal agencies to assure that the actions they authorize, fund, or carry out, are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy their critical habitat is a substantive requirement with which the Navy will comply. The consultation requirement of 7(a) is an administrative requirement and is, therefore, not an ARAR.

TABLE C-2: FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Record of Decision, Site 27 – Northern Channel, Former Naval Air Station Moffett Field, California

Applicable or Relevant and Appropriate Requirements Determination*				Comments
Location	Requirement	Prerequisite	Citation	
Federal Requirements				
Coastal Zone Management Act (Title 16 USC Section 1451-1464)				
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone including lands there under and adjacent shore land.	Title 16 USC Section 1456(c) Title 15 CFR Part 930	RA The remedial action will have some short-term impact on the coastal zone, in general, and marshes, specifically. The affected areas will be restored to their current use.
Endangered Species Act of 1973 (Title 16 USC Sections 1531-1543)				
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect upon endangered or threatened species or its habitat. Critical habitat upon which endangered species or threatened species depend.	Title 16 USC Section 1536(a), (h)(1)(B)	RA Although no endangered species were identified in the area of the Northern Channel, pickleweed was identified along the slopes of the Northern Channel. The salt marsh harvest mouse, a federal and state endangered and threatened species, may visit the pickleweed in the Northern Channel areas. In addition, the California brown pelican, American peregrine falcon, California least tern, and the California clapper rail may visit the Northern Channel. In accordance with 50 CFR Part 17, Subpart B and Part 226 Subparts B, C, and D, no critical habitat exists in the Northern Channel area.

TABLE C-2: FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Record of Decision, Site 27 – Northern Channel, Former Naval Air Station Moffett Field, California

Location	Requirement	Prerequisite	Citation	Applicable or Relevant and Appropriate Requirements Determination*	Comments
Federal Requirements (Continued)					
Migratory Bird Treaty Act of 1972 (Title 16 USC Sections 703–712)					
Migratory bird area	Protects almost all species of native migratory birds in the United States from unregulated "take," which can include poisoning at hazardous waste sites.	Presence of migratory birds.	Title 16 USC Section 703	RA	The substantive portions are relevant and appropriate as migratory birds have been observed at the site.
Rivers and Harbors Act of 1899 (Title 33 USC Sections 401–413)					
Navigable waters	Permits required for structures or work in or affecting navigable waters.	Activities affecting navigable waters.	Title 33 USC Section 403 Title 33 CFR Part 322	RA	The substantive provisions of this requirement are relevant and appropriate requirements for dredging which may affect navigable waters.
Clean Water Act of 1988, as Amended, Section 404 (Title 33 USC Section 1344)					
Wetland	Action to prohibit discharge of dredged or fill material into wetland without permit	Wetland as defined by Executive Order No. 11990 Section 7.	Title 33 USC Section 1344 Title 40 CFR Section 230.10	A	The substantive provisions are applicable for the discharge of dredged or fill material to a wetland.
Executive Order No. 11990, Protection of Wetlands					
Wetland	Action to minimize the destruction, loss, or degradation of wetlands.	Wetland meeting definition of Section 7.	Title 40 CFR Section 6.302(a)	A	The substantive provisions of Title 40 CFR Section 602(a) are applicable requirements for the response action. The Navy will minimize the impacts to wetlands when implementing the response action.

TABLE C-2: FEDERAL AND STATE LOCATION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Record of Decision, Site 27 – Northern Channel, Former Naval Air Station Moffett Field, California

Location		Applicable or Relevant and Appropriate Requirements Determination ^a			Comments
State Requirements					
California Endangered Species Act (<i>California Fish and Game Code</i> Sections 2050-2116)					
Endangered species habitat	No person shall import, export, take, possess, or sell any endangered or threatened species or par or product thereof.	Threatened or endangered species determination on or before January 1, 1985 or a candidate species with proper notification.	<i>California Fish and Game Code</i> Section 2080	RA	Although no endangered species were identified in the area of the Northern Channel, pickleweed was identified along the slopes of the Northern Channel. The salt marsh harvest mouse, a federal and state endangered and threatened species may visit or reside in the pickleweed in the Northern Channel areas.
California Fish and Game Code					
Waters of the state	Prohibits depositing in, permitting to pass into, placing where it can pass into waters of the state petroleum acid, coal or any substance or material deleterious to fish, plant life or bird life.	Deposit of material deleterious to fish, plant or bird life.	<i>California Fish and Game Code</i> Section 5650(a)	RA	The substantive provisions of 5650(a) are relevant and appropriate.

Notes:

- a Indicates whether the requirement is applicable or relevant and appropriate for Alternatives 2 through 5.
- A Applicable
- CFR Code of Federal Regulations
- RA Relevant and appropriate
- USC United States Code

The Navy determined that the substantive provisions of the Endangered Species Act contained in Title 16 USC Section 1536(a) and 1536(h)(1)(B) are ARARs for the remedial action for contaminated sediment at the Northern Channel and related areas because the action may directly or indirectly modify the land or water where federal and state endangered species may visit or reside. Although no endangered species were identified in the area of the Northern Channel, pickleweed was identified along the slopes of the Northern Channel. The salt marsh harvest mouse, a federal and state endangered and threatened species, may visit the pickleweed in the Northern Channel areas. In addition, the California brown pelican, American peregrine falcon, California least tern, and the California clapper rail may visit the Northern Channel.

Migratory Bird Treaty Act of 1972

The Migratory Bird Treaty Act (Title 16 USC Sections 703–712) prohibits at any time, using any means or manner, the pursuit, hunting, capturing, and killing or attempting to take, capture, or kill any migratory bird. This act also prohibits the possession, sale, export, and import of any migratory bird or any part of a migratory bird, as well as nests and eggs. A list of migratory birds for which this requirement applies is found at Title 50 CFR Section 10.13. It is the Navy's position that this act is not legally applicable to Navy actions; however, Executive Order No. 13186 (dated January 10, 2001) requires each federal agency taking actions that have or are likely to have a measurable effect on migratory bird populations to develop and implement, within 2 years, a memorandum of understanding with the United States Fish and Wildlife Service to promote the conservation of such populations. The Department of Defense and the United States Fish and Wildlife Service are in the process of negotiating this memorandum of understanding. In the meantime, the Migratory Bird Treaty Act will continue to be evaluated as a potentially relevant and appropriate requirement for Navy response actions under the Comprehensive Environmental Response, Compensation, and Liability Act.

The response action will comply with the Migratory Bird Treaty Act.

C3.1.2 State

Only the California Endangered Species Act was identified as a state ARAR. *California Fish and Game Code* Section 2080 (the California Endangered Species Act) prohibits importing, exporting, taking, possessing, or selling of any endangered species. The substantive provisions of Section 2080 are also relevant and appropriate, and the Navy has selected it as an ARAR.

C3.2 COASTAL RESOURCES APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

C3.2.1 Federal

Coastal Zone Management Act

Only the Coastal Zone Management Act was identified as a federal ARAR for coastal resources. The Coastal Zone Management Act (Title 16 USC Section 1451-1464) specifically excludes federal lands from the coastal zone (Title 16 USC Section 1453[1]). Therefore, the Coastal Zone

Management Act is not potentially applicable, but it may be relevant and appropriate. Section 1456(a)(1)(A) requires each federal agency activity within or outside the coastal zone that affects any land or water use or natural resource to conduct its activities in a manner that is consistent to the maximum extent practicable with enforceable policies of approved state management policies. A state coastal zone management program is developed under state law guided by the Coastal Zone Management Act and its accompanying implementing regulations in Title 15 CFR Part 930. A state program sets forth objectives, policies and standards to guide public and private uses of lands and water in the coastal zone.

California's approved coastal management program includes the San Francisco Bay Plan (hereinafter referred to as the "Bay Plan") developed by the San Francisco Bay Conservation and Development Commission (2002). The Bay Conservation and Development Commission was formed under the authority of the McAteer-Petris Act, *California Government Code* Section 66600 et seq. and subsequent sections, which authorizes the Bay Conservation and Development Commission to regulate activities within San Francisco Bay and the shoreline (100 feet landward from the shoreline) in conformity with the policies of the Bay Plan. The McAteer-Petris Act and the Bay Plan were developed primarily to halt uncontrolled development and filling of the bay. Their broad goals include reducing fill and disposal of dredged material in the bay, maintaining marshes and mudflats to the fullest extent possible to conserve wildlife and abate pollution, and protecting the beneficial uses of the bay.

The Navy determined that the Coastal Zone Management Act and its implementing regulation at Title 15 CFR Part 930 are ARARs. The coastal zone will not be permanently altered by the remedial action. The affected area will either remain as it is (no action) or will be restored to its current use (excavation and capping alternatives). The selected remedial action will be designed to minimize short-term and temporary effects anticipated for this area.

C3.2.1 State

No state ARARs were identified for coastal resources.

C3.3 HYDROLOGIC RESOURCES APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

C3.3.1 Federal

Rivers and Harbors Act

Section 10 of the Rivers and Harbors Act of 1899 prohibits the creation of any obstruction not authorized by Congress to the navigable capacity of any of the waters of the United States (Title 33 USC Sections 401-413). It prohibits construction of wharves, piers, booms, weirs, breakwaters, bulkheads, jetties, or other structures in a port unless the construction is approved by the U.S. Army Corps of Engineers. In addition, excavation or filling of any port, harbor, channel, lake or any navigable water is prohibited without authorization. Section 10 permits are required for these activities. Section 10 permits cover construction, excavation, or deposition of materials in, over, or under navigable waters, or any work that would affect the course, location,

condition, or capacity of those waters. Implementing regulations for Section 10 permits are codified at Title 33 CFR Part 322. The Navy has selected the substantive provisions of Title 33 USC Section 403 and Title 33 CFR Part 322 as ARARs for excavation of sediment to the extent excavation affects navigable waters.

C3.3.2 State

No state ARARs were identified for hydrologic resources.

C3.4 WETLANDS PROTECTION APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

C3.4.1 Federal

Protection of Wetlands, Executive Order No. 11990

Executive Order No. 11990 requires that federal agencies minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial value of wetlands; and avoid support of new construction in wetlands if a practicable alternative exists.

While Executive Orders themselves are not ARARs, they constitute "to be considered" criteria guidance that should be followed in any response action. Executive Order 11990 is codified at Title 40 CFR Section 6.302(a). The substantive portions of Title 40 CFR Section 6.302(a) are ARARs for response actions within a wetland. Adverse impacts to wetlands will be minimized during the response action.

Clean Water Act (Title 33 USC Section 1344)

Section 404 of the Clean Water Act of 1977 governs the discharge of dredged and fill material into the waters of the United States, including adjacent wetlands. Wetlands are areas that are inundated by water frequently enough to support vegetation typically adapted for life in saturated soil conditions. Wetlands include swamps, marshes, bogs, sloughs, potholes, wet meadows, river overflows, mudflats, natural ponds, and similar areas. Both the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers have jurisdiction over wetlands. U.S. Environmental Protection Agency's Section 404 guidelines are promulgated in Title 40 CFR Part 230, and the U.S. Army Corps of Engineer's guidelines are promulgated in Title 33 CFR Part 320.

The Navy has selected the substantive requirements of Title 33 USC Section 1344, Section 404, and the implementing regulations at Title 40 CFR Section 230.10 as ARARs for any dredging or filling of wetlands.

C3.4.2 State

California Fish and Game Code Section 5650(a) states that it is unlawful to deposit in, permit to pass into, or place in to the waters of the state any of the following including, but not limited to, petroleum, acid, coal or oil tar, lampblack, aniline, asphalt, bitumen, or residuary product of petroleum, or carbonaceous material or substance; or any substance or material harmful to fish, plant life, or bird life. The Navy has selected the substantive provisions of this section as ARARs.

C4 ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The federal action-specific applicable or relevant and appropriate requirements (ARAR) include Resource Conservation and Recovery Act (RCRA), the Hazardous Materials Transportation Law, the Clean Air Act, the Clean Water Act and Toxic Substances Control Act (TSCA). The state action-specific ARARs include: Title 22 *California Code of Regulations* (CCR) Section 66261.24(a)(2) and Title 27 CCR Sections 20210, 20220 and 20230. Table C-3 presents and evaluates federal and state ARARs for excavation of contaminated sediments.

C4.1 FEDERAL

Resource Conservation and Recovery Act

Waste generated as a result of excavation will be characterized to determine if it is hazardous. The excavated sediment may be classified as a federal hazardous waste, as defined by RCRA and the state-authorized program, or as non-RCRA, state-regulated hazardous waste. If the sediment is deemed hazardous waste, the appropriate requirements will apply.

The federal RCRA requirements at Title 40 *Code of Federal Regulations* (CFR) Part 261 do not apply in California because the state RCRA program is authorized. The authorized state RCRA requirements are therefore considered federal ARARs. The applicability of RCRA requirements depends on whether the waste is a RCRA hazardous waste, whether the waste was initially treated, stored, or disposed of after the effective date of the particular RCRA requirement, and whether the activity at the site constitutes treatment, storage, or disposal as defined by RCRA. However, RCRA requirements may be relevant and appropriate even if they are not applicable. Examples include activities that are similar to the definition of RCRA treatment, storage, or disposal for waste that is similar to RCRA hazardous waste.

The determination of whether a waste is an RCRA hazardous waste can be made by comparing the site waste with the definition of RCRA hazardous waste. The Navy determined that the RCRA requirements at Title 22 CCR Sections 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it exhibits the toxicity characteristic of hazardous waste. This determination is made by using the toxicity characteristic leaching procedure. The maximum concentrations allowable for the toxicity characteristic leaching procedure listed in Section 66261.24(a)(1)(B) are federal ARARs for determining whether the site has hazardous waste. If concentrations in the site waste exceed these values, it is determined to be a characteristic RCRA hazardous waste.

TABLE C-3: FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
Record of Decision, Site 27 – Northern Channel, Former Naval Air Station Moffett Field, California

Action	Applicable or Relevant and Appropriate Requirements Determination ^a	Comments
Federal Requirements		
Resource Conservation and Recovery Act (Title 42 USC, Chapter 82, Sections 6901-6991[j])		
Excavation	<p>Definition of RCRA hazardous waste.</p> <p>Soil and water</p> <p>Title 22 CCR Sections 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1) and 66261.100</p> <p>A</p>	<p>The requirements of Title 22 CCR, Division 4.5, Chapter 14 are applicable for determining whether excavated material contains hazardous waste. These requirements may also be relevant and appropriate to excavated material that is similar or identical to RCRA hazardous waste or non-RCRA hazardous waste</p>
Hazardous waste accumulation	<p>On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers or tanks, on drip pads, inside buildings, is labeled and dated, etc.</p> <p>Accumulate hazardous waste</p> <p>Title 22 CCR Section 66262.34</p> <p>A</p>	<p>These requirements are applicable if hazardous waste is generated and accumulated on-site before transport.</p>
Land disposal	<p>Requires generators of hazardous waste to determine if waste has to be treated before it can be land disposed. Requires generators to notify treatment facility if a waste is subject to land disposal restrictions and does not meet applicable treatment standards. If the waste meets treatment standards, generators must sign a certification.</p> <p>Hazardous waste land disposal</p> <p>Title 22 Sections 66268.1(f), 66268.7</p> <p>A</p>	<p>These requirements are applicable if hazardous waste is to be land disposed.</p>

TABLE C-3: FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Record of Decision, Site 27 – Northern Channel, Former Naval Air Station Moffett Field, California

Action	Requirement	Prerequisite	Citation	Applicable or Relevant and Appropriate Requirements Determination ^a	Comments
Federal Requirements (Continued)					
Resource Conservation and Recovery Act (Title 42 USC, Chapter 82, Sections 6901-6991(ii))					
Pretransport requirements	Hazardous waste must be packaged in accordance with DOT regulations before they are transported.	Any operation where hazardous waste is generated	Title 22 CCR Section 66262.30	A	These requirements are applicable if hazardous waste is to be transported.
	Hazardous waste must be labeled in accordance with DOT regulations before they are transported.	Any operation where hazardous waste is generated	Title 22 CCR Section 66262.31	A	These requirements are applicable if hazardous waste is to be transported.
	Provides requirements for marking hazardous waste before they are transported.	Any operation where hazardous waste is generated	Title 22 CCR Section 66262.32	A	These requirements are applicable if hazardous waste is to be transported.
	A generator must ensure that the transport vehicle is correctly placarded prior to transport of hazardous waste.	Any operation where hazardous waste is generated	Title 22 CCR Section 66262.33	A	These requirements are applicable if hazardous waste is to be transported.
	Requires preparation of a manifest for transport of hazardous waste off-site.	Any operation where hazardous waste is generated	Title 22 CCR Sections 66262.20-66262.23	A	These requirements are applicable if hazardous waste is to be transported.

TABLE C-3: FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Record of Decision, Site 27 – Northern Channel, Former Naval Air Station Moffett Field, California

Action	Requirement	Prerequisite	Citation	Applicable or Relevant and Appropriate Requirements Determination ^a	Comments
Federal Requirements (Continued)					
Clean Air Act (Title 42 USC Section 7401 et seq.) (Continued)					
Excavation	Prohibits emissions that are as dark as or darker than No.1 on the Ringelmann Chart and sets forth opacity limitations.	Excavation	BAAQMD Regulations 6, Regulations 6-301 and 6-302	A	These requirements are applicable for excavation.
	Prohibits the emission of particles in sufficient number to cause annoyance.	Release of particles	BAAQMD Regulation 6-305	Applicable	This requirement is applicable for excavation.
	Provides requirements for maintaining, covering and stockpiling excavated soil.	Soil stockpile	BAAQMD Regulation 8, Rule 40	A	These requirements are applicable for excavation.
Federal Hazardous Materials Transportation Law (Title 49 USC Sections 5101-5127)					
Transportation of hazardous material Title 49 USC Sections 5101-5127	Sets forth requirements for transporting hazardous waste including representations that containers are safe, prohibitions on altering labels, marking requirements, labeling requirements and placarding requirements.	Interstate carriers transporting hazardous waste and substance by motor vehicle	Title 49 CFR Sections 171.2(f), 171.2(g), 172.300, 172.301, 172.302, 172.303, 172.304, 172.312, 172.400, 172.504	RA	Relevant and appropriate for transporting hazardous materials on-site.
Clean Water Act of 1988, as Amended, Section 404 (Title 33 USC Section 1344)					
Discharge of water	Establishes the requirements for a National Pollutant Discharge Elimination System permit for discharge to waters of the United States.	Discharge of wastewater	Title 40 CFR Part 122 Subpart C	RA	Water generated while one section of the Northern Channel is dewatered will be discharged to another section of the channel. The substantive requirement of Title 40 CFR Part 122 Subpart C will be followed in addressing the new point discharge.

TABLE C-3: FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)

Record of Decision, Site 27 – Northern Channel, Former Naval Air Station Moffett Field, California

Action	Requirement	Prerequisite	Citation	Applicable or Relevant and Appropriate Requirements Determination ^a	Comments
Federal Requirements (Continued)					
Clean Water Act of 1988, as Amended, Section 404 (Title 33 USC Section 1344) (Continued)					
Storm water discharge	Order 99-08-DQW is the State of California general permit for stormwater discharge from construction. It requires use of best management practices to reduce pollutants.	Storm water discharge	State Water Resources Control Board Order 99-08 adopted pursuant to Title 40 CFR Part 122, Subpart C	RA	Order 99-08—DQW applies to excavation activities that affect at least 1 acre. Pursuant to the substantive permit requirements, best management practices will be taken to prevent contacting pollutants from contacting stormwater and keep erosions products from moving off site.
Toxic Substances Control Act (15 USC Chapter 53 Sections 2601-2692)					
Disposal of PCBs	Provides options for disposing of PCB remediation waste and requirements to implement each option.	Remedial actions involving PCBs	Title 40 CFR Section 761.61	RA	Excavated sediment containing PCBs may be disposed of in accordance with the requirements of this regulation.
Storage of PCB remediation waste	Establishes requirements for storage of PCB remediation wastes released into the environment.	Storage of PCBs	Title 40 CFR Sections 761.65(c)(4) and (c)(9)	RA	Excavated sediment that contains PCBs may be stored on site up to 180 days. The storage area must have a liner, cover, and runoff control system.
Toxic Substances Control Act (Title 15 USC Chapter 53 Sections 2601-2692)					
Decontamination standards for water containing PCBs	Establishes standards for the disposal of water used for decontamination of equipment used in excavation, storage, and treatment of PCB remediation waste.	Decontamination of water	Title 40 CFR Section 761.79(b)(1)	RA	The decontamination standard for PCBs is less than 3 micrograms per liter for water discharges to a publicly owned treatment works or to navigable waters or less than or equal to 0.5 microgram per liter PCBs for unrestricted use.

TABLE C-3: FEDERAL AND STATE ACTION-SPECIFIC APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (CONTINUED)
Record of Decision, Site 27 – Northern Channel, Former Naval Air Station Moffett Field, California

Action	Requirement	Prerequisite	Citation	Applicable or Relevant and Appropriate Requirements Determination ^a	Comments
State Requirements					
Characterization of waste	Definition of "non-RCRA hazardous waste."	Waste.	Title 22 CCR Sections 66261.24(a)(2) and 66261.101	A	Applicable for determining whether a waste is a non-RCRA hazardous waste.
	Contains criteria for characterizing the waste as either designated, nonhazardous, or inert waste.	Designated waste	Title 27 CCR Sections 20210, 20220 and 20230	A	Representative samples of excavated sediment must be tested to identify appropriate disposal requirements.
Stormwater discharge	Establishes the state stormwater permit program and sets forth substantive conditions for construction sites larger than 1 acre.	Stormwater discharge	State Water Resources Control Board Order 99-08 adopted pursuant to Title 40 CFR Part 122, Subpart C	RA	Order 99-08—DQW applies to excavation activities that affect at least 1 acre. Pursuant to the substantive permit requirements, best management practices will be taken to prevent contacting pollutants from construction stormwater and keep erosions products from moving off site.

Notes:

a Indicates whether the requirement is applicable or relevant and appropriate for Alternatives 2 through 4.

BAAQMD
Bay Area Air Quality Management District
CCR
California Code of Regulations
CFR
Code of Federal Regulations
DOT
Department of Transportation
PCB
Polychlorinated biphenyl
RCRA
Resource Conservation and Recovery Act
USC
United States Code

RCRA land disposal restrictions at Title 22 CCR Section 66268.1(f) are federal ARARs for discharging waste to land. This section prohibits the disposal of hazardous waste to land unless (1) it is treated in accordance with the treatment standards of Title 22 CCR Section 66268.40 and the underlying hazardous constituents meet the Universal Treatment Standards at Title 22 CCR Section 66268.48; (2) it is treated to meet the alternative soil treatment standards of Title 22 CCR Section 66268.49; or (3) a treatability variance is obtained under Title 22 CCR Section 66268.44. The Navy determined that Title 22 CCR Section 66268.1(f) is an ARAR.

The Navy also determined that Title 22 CCR Section 66268.7 is an ARAR. Before any waste is sent off site, the Navy will determine whether the waste is subject to land disposal restrictions and will provide the required notices and certifications of Section 66268.7.

As long as the excavated material remains inside the area of contamination, it is not newly generated and will not be subject to RCRA generator, treatment, or other waste management requirements. Should excavated material be moved outside the area of contamination, however, the substantive RCRA requirements managing hazardous waste including land disposal restrictions would be applicable.

Any hazardous waste accumulated on site, including waste contained in soil and contaminated groundwater, must comply with the RCRA requirements set forth at Title 22 CCR Section 66262.34. This section permits on-site hazardous waste accumulation for up to 90 days as long as the waste is properly stored and labeled. The Navy determined that the following RCRA requirements are ARARs for hazardous waste sent off site for disposal at a disposal facility: the RCRA pre-transport regulations at Title 22 CCR Sections 66262.30 (packaging), 66262.31 (labeling), 66262.32 (marking) and 66262.33 (placarding) and RCRA manifest requirements at Sections 66262.20, 66262.21, 66252.22, and 66262.23. Transfer of any hazardous substances, pollutants or contaminants to an off-site facility will meet the requirements of Comprehensive Environmental Response, Compensation, and Liability Act Section 121(d)(3)(A) and (B) and Title 40 CFR Section 300.440 (the Comprehensive Environmental Response, Compensation, and Liability Act Off-site Rule).

Hazardous Materials Transportation Law

The regulations under the Hazardous Materials Transportation Law (Title 49 *United States Code* Sections 5101-5127) govern the transport of hazardous materials. The Navy determined that the substantive provisions of Title 49 CFR Sections 171.2(f), 171.2(g), 172.300, 172.301, 172.302, 172.303, 172.304, 172.312, 172.400, and 172.504 are ARARs for this response action. The definition of "person" under these regulations includes offering "hazardous material for transportation in commerce or transporting hazardous material to further a commercial purpose." Based on this definition, these sections are not applicable; however, they are relevant and appropriate for transport of materials.

Clean Air Act

The Navy determined the following Bay Area Air Quality Management District regulations are ARARs for excavation activities:

- Regulation 6-301: Ringelmann No. 1 Limitation (regulating emissions that are as dark as or darker than No. 1 on the Ringelmann Chart)
- Regulation 6-302: Opacity Limitation (prohibiting emissions for a period aggregating more than 3 minutes in any hour an emission equal to or greater than 20 percent opacity)
- Regulation 6-305: Visible Particles (prohibiting the emissions of particles in sufficient number to cause annoyance)
- Regulation 8, Rule 40: Aeration of Contaminated Soil and Removal of Underground Storage Tanks (setting forth standards for maintaining, covering, and stockpiling soil)

Clean Water Act

State Water Resources Control Board Order 99-08 is the state of California General Permit for Discharge of Stormwater Associated with Construction Activities, issued pursuant to Title 40 CFR Part 122 Subpart C. The substantive permit requirements are the use of best management practices to prevent construction pollutants from contacting stormwater and to keep erosion products from moving off site. During excavation, best management practices would be used to prevent construction pollutants from contacting stormwater and to minimize erosional products from moving off site, in accordance with Order 99-08.

Before the channel is excavated, the entire channel would be dewatered from the Lockheed Pump Station into the Moffett Channel. Any groundwater seepage during excavation will also be removed from the channel. The only ARARs that would apply to handling water removed from the channel are the Clean Water Act, National Pollution Discharge Elimination System requirements. The substantive requirements of a National Pollutant Discharge Elimination System permit (Title 40 CFR Part 122 Subpart C) will be followed to discharge the water further downstream in the Northern Channel.

Toxic Substances Control Act

Section 761.61(a)(5)(i)(B)(iii) requires that polychlorinated biphenyl (PCB) remediated waste that contains more than 50 parts per million (or 50 milligrams per kilogram) taken off site must be disposed of in a landfill permitted under Section 3004 of RCRA (referred to as a Title C landfill) or a permitted PCB disposal facility such as an incinerator. Under 40 CFR 761.61(a)(5)(i)(B)(2)(ii), soil contaminated with PCBs at a concentration less than 50 parts per million (or 50 milligrams per kilogram) may be disposed of in a permitted state municipal landfill or a nonhazardous nonmunicipal landfill (Class III). If the concentration of PCBs does not meet any of the criteria for PCB remediation waste and if no contaminant analyzed meets the criteria for hazardous waste or as a state-designated waste, none of the Toxic Substances Control

Act regulations in Title 40 CFR Part 761 or the requirements at CCR Titles 22, 23, or 27 for storage, treatment, and disposal will be applicable.

Excavated sediments that are PCB remediation waste will be managed in accordance with PCB remediation waste storage and disposal requirements and decontamination procedures specified in federal PCB regulations, including Title 40 CFR Sections 761.65(c)(9), 761.61, and 761.79(b)(1), which the Navy determined to be ARARs. The Navy has also determined that Title 40 CFR Sections 761.61(a)(5)(i)(B)(iii) and 761.61(a)(5)(i)(B)(ii), which provide options for disposal of PCB remediation waste, are ARARs. The Navy has determined that Title 40 CFR Section 761.65(c)(4), which establishes the requirements for storage of PCB remediation waste, is an ARAR. The excavated sediment that contains PCBs may be stored on site up to 180 days in a lined storage area. The Navy has selected the decontamination standard of less than 3 micrograms per liter in 40 CFR Section 761.79(b)(1) for waste discharged to a publicly owned treatment work or to navigable waters. The decontamination water either will meet the standard or will be disposed off site.

C4.2 STATE

State RCRA requirements included within the U.S. Environmental Protection Agency-authorized RCRA program for California are considered federal ARARs and are discussed above. When state regulations are either broader in scope or are more stringent than their federal counterparts, they are considered state ARARs. State requirements such as the non-RCRA, state-regulated hazardous waste requirements may be potential state ARARs because they are not within the scope of the federal ARARs (Title 57 *Federal Register* 60848). Title 22 CCR Division 4.5 requirements that are part of the state-approved RCRA program would be potential state ARARs for non-RCRA, state-regulated hazardous wastes.

The site waste characteristics must be compared with the definition of non-RCRA, state-regulated hazardous waste. The Navy determined that the non-RCRA, state-regulated waste definitions in Title 22 CCR Sections 66261.24(a)(2) and 66261.101 are ARARs for determining whether other RCRA requirements are potential state ARARs. This section lists the total threshold limit concentrations and soluble threshold limit concentrations. The site waste may be compared with these thresholds to determine whether it meets the characteristics for a non-RCRA, state-regulated hazardous waste.

Title 27 CCR Sections 20210, 20220 and 20230 are state definitions for designated waste and nonhazardous waste. The Navy determined that these are ARARs for soil that meets the definitions.

Finally, the Navy determined that the substantive provisions of California stormwater requirements of State Water Resources Control Board Order No. 99-08-DWQ are ARARs.

C5 SUMMARY

Applicable or relevant and appropriate requirements (ARAR) have been identified in the text of this appendix for each medium, for each location, and for the remedial action.

The only federal chemical-specific ARARs identified for the Northern Channel and related areas are the polychlorinated biphenyl (PCB) remediation waste cleanup standards in Title 40 *Code of Federal Regulations* (CFR) 761.61(a)(4)(i). The cleanup goal for bulk remediation waste in high occupancy areas is less than or equal to 1 part per million (or 1 milligram per kilogram) without further conditions and 25 parts per million (or 25 milligrams per kilogram) for low-occupancy areas. However, because the Northern Channel and related areas are ecologically sensitive areas, a lower cleanup goal has been established that exceeds the requirements of Toxic Substances Control Act.

The only state chemical-specific ARARs are the substantive requirements of the "Definitions of Beneficial Uses," "Present and Potential Beneficial Uses, Surface Waters," and "the Santa Clara Valley Basin section of Table 2-9" provisions of Chapter 2 of the Basin Plan (San Francisco Bay Regional Water Quality Control Board 1995).

The evaluation of location-specific ARARs indicates that the Section 307(c) of the Coastal Zone Management Act, Section 7 of the Endangered Species Act, Section 10 of the Rivers and Harbors Act, Section 404 of the Clean Water Act, the California Endangered Species Act, and *California Fish and Game Code* Sections 2080 and 5650(a) are ARARs for the Northern Channel and related areas.

The remedial action for the Northern Channel and related areas consists of excavation and off-site disposal of contaminated sediments. For excavation itself, the substantive requirements of Title 40 CFR Part 122 Subpart C; Bay Area Air Quality Management District Regulations 6-301, 6-302, 6-305 and Regulation 8, Rule 40, and State of California Water Resource Control Board Order 99-08-DQW are considered ARARs. For characterization of the sediments, the specific requirements of Title 22 *California Code of Regulations* (CCR), Division 4.5, Chapter 12, Article 1, Sections 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1) and (2) and 66261.100, 66261.101; Title 22 CCR Chapter 27, Sections 20210, 20220, and 20230; and Title 40 CFR Section 761.61 are ARARs. These sections consist of designated waste characterizing requirements and any pertinent PCB characterizing requirements. If excavated sediments are PCB remediation waste, they should be managed in accordance with PCB remediation waste storage and disposal requirements and decontamination procedures specified in federal PCB regulations, including Title 40 CFR Sections 761.65(c)(4) and (9), 761.61, and 761.79(b)(1). For off-site disposal, the substantive requirements of Title 22 CCR Sections 66262.30, 66262.31, and 66262.32 for transportation of hazardous waste apply for packaging, labeling, and marking the waste in accordance with U.S. Department of Transportation regulations before transportation are considered ARARs.

C6 REFERENCES

- Bay Conservation and Development Commission. 2002. "San Francisco Bay Plan." August. As amended through June 2003. Available Online at: <http://www.bcdc.ca.gov/library/bayplan/bayplan.htm>
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- EPA. 2004. "EPA Region IX Preliminary Remediation Goals (PRG) 2004." October. Available Online at: <http://www.epa.gov/region09/waste/sfund/prg/index.htm>

ATTACHMENT 2
RESPONSE TO COMMENTS

RESPONSE TO COMMENTS
DRAFT REMEDIAL DESIGN REPORT FOR INSTALLATION RESTORATION SITE 27
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NASA Comments	
Comment 1. Page 4-4, 2 nd Paragraph, line 6 – after “required” insert “, because neither species is federally listed”	Response 1. Comment noted.
Comment 2. Page 4-4, 2 nd Paragraph, line 7 – delete “by”	Response 2. Comment noted.
Comment 3. Page 4-6, Table 4-1 – Western Snowy Plover should be added, since they have been confirmed in the vicinity.	Response 3. Comment noted. The Western Snowy Plover will be added to Table 4-1.
General Western Pond Turtle	
NASA would like to conserve the Northern Channel fishery through a salvaging program. The timing of fish salvage would depend on the dewatering operation. When sections are drained to small pools, NASA would remove fish by a dip net and transport them to the next section that is still inundated. Upon completion of remediation, the salvaging program would provide a head start to fish re-colonization, and the necessary food supply for pond turtles when they are returned. Fish salvaging should not affect the remediation schedule.	Comment noted. We will work with NASA to conserve the Northern Channel fishery.
Comment 4. Page 7-1, Roads and Turnouts: 2. – Safety factor of 1.2, but Executive Summary states 1.8. Which will it be?	Response 4. From Executive Summary: It was determined that a haul truck, with a surcharge loading of 3,326 pounds per square foot (psf), would have an adequate factor of safety (F.S.) of 1.8. It should be noted that during construction activities, a F.S. of 1.2 is considered satisfactory which is lower than the calculated value.
Comment 5. Page 7-2, 7.2, lines 5&6 – Technical specifications should be Appendix J and drawings, Appendix I.	Response 5. Comment noted
Comment 6. Page 7-9, 1st and 2nd Paragraph – F.S. of 1.5 used for long-term performance. Is this distinction necessary and will these different ratings be confirmed in the field or are they estimates.	Response 6. During construction, a F.S. of 1.2 will be utilized. A F.S. of 1.5 is a design factor of safety and is recommended for the long term performance. These numbers were obtained from modeling the geotechnical data obtained during pre-design activities and will not be confirmed in the field.

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San Francisco Bay Regional Water Quality Control Board Comments

General Comments

Comment 1. Use of lime kiln dust (LKD) as a solidifying reagent on-site may be problematic. This product is basic and reacts with water to produce a pH 12.4 solution and heat (<http://www.graymont.com/msds/MSDS-Dolomitic Lime Kiln Dust May 2005.PDF>). In contrast, the waste lock polymer material (WLPM) is not caustic and is chemically stable as long as complete polymerization occurred. Therefore, WLPM may be preferable due to the reduced likelihood of collateral impacts.

Response 1. The WLPM will be used, if needed, during remedial activities. The LKD was used during the bench scale study for comparison purposes. The study showed that the reagent/mixing ratio of WLPM at 0.6-1.0 percent would be selected for implementation during remedial activities.

Comment 2. The use of U.S. Environmental Protection Agency (EPA) Region IX industrial preliminary remediation goals (PRGs) as the action levels for backfill soil and clay is inappropriate for the following reasons: (1) the industrial PRGs exceed the Site 27 remedial action objectives (RAOs) for all Site 27 chemicals of concern (COCs); (2) the RAOs were developed to protect ecological receptors on-site whereas the industrial PRG protect human workers; and (3) the industrial PRGs exceed generic ecological benchmarks for non-COC chemicals. Imported material used for backfill should not exceed Site 27 RAOs and generic ecological benchmarks for non-COC chemicals.

Response 2. Based on a recommendation from the Water Board, there will not be any backfill brought in to replace the sediment that will be removed from the ditches and Northern Channel. Soil backfill brought in to replace the soil that will be removed from the berms will not exceed residential PRGs for soil as specified in the ROD

Comment 3. Some of the applicable DFG ARARs have changed since the April 5, 2005 letter was provided. A table that summarizes current DFG ARARs can be provided upon request.

Response 3 On November 30, 2005, the Navy requested a copy of the April 5, 2005, letter and the table summarizing the current DFG ARARs. The Navy will review the changes to the ARARs prior to agreeing to incorporate them into the Draft Final Remedial Design Report. In accordance with the National Contingency Plan (NCP), these ARARs that have been proposed after the Site 27 Record of Decision was finalized will be included only when they have been determined to be applicable or relevant and appropriate and necessary to ensure that the remedy is protective of human health and the environment.

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Specific Comments	
<p>Comment 1. Page 3-3 Section 3.2. The narrative regarding fish and wildlife at the three channels appears extensive and provides a good understanding of the biological resources. A brief appendix to the draft Final RD with representative photos of each of the three channels would further help depict current habitat conditions.</p>	<p>Response 1. Comment noted. Representative photos will be taken and included in the Draft Final RD document.</p>
<p>Comment 2. Pages 4-3, 4-4, Section 4.2. The discussion of the role of the DFG and the California Endangered Species Act (ESA) should reflect that Section 1600, 1601, and 1602 of the Fish and Game code are no longer identified as ARARs. [1]In addition, Fish and Game Code Section 2080 is applicable to State candidate, threatened, and endangered species.[2} Burrowing owl mitigation should be consistent with the DFG's Staff Report on Burrowing Owl Mitigation dated October 17, 2005 [1995?]. With respect to the western pond turtle, we understand that the National Aeronautics and Space Administration has developed a capture/relocation protocol for surveys of this species, consisting of trapping turtles, taking them to a fenced enclosure, and releasing them when the work is completed. This or an equivalent protocol could be referenced for consideration in the draft final RD.[3]</p>	<p>Response 2. [1] Comment noted. The text will be edited to reflect the Final Record of Decision.</p> <p>[2] Comment noted. On December 13, 2005, the Navy requested and received a copy of the DFG's Staff Report on Burrowing Owl Mitigation dated October 17, 1995. The original comment had a typo and reflected the date of the Report as prepared in 2005, when it was prepared in 1995.</p> <p>[3] NASA will be responsible for relocating the western pond turtles following the protocol they developed. We will request a copy of the protocol and, if received, will be included into the Remedial Action Work Plan.</p>
<p>Comment 3. Page 4-6, Section 4.2. The reference to the federal ESA should be expanded to recognize the presence of species that receive protection under the California ESA (Fish and Game Code 2050-2079, 2080). The sections are applicable to all of the bird and mammal species listed in Table 4-1. These code sections were included in ARARs that we provided in 2001[1], and are still applicable at Site 27.</p>	<p>Response 3. Comment noted</p>

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Comment 4. Page 6-5, Section 6.9. The design and location of the retention basins are not described. In particular, the measures that will be taken to ensure wastewater does not leak out of the basins should be detailed. The frequency of sampling and the analyte list are also needed. If this information is presented later in the document, then references to the subsequent sections may be sufficient.

Response 4. Comment noted. The design and location of the retention basin are shown on drawings C-3, C-4, and C-10 of Appendix I of the Draft RD. The basin will be constructed and lined with a 30 mils (1/1000 of an inch) high density polyethylene (HDPE) or polyvinyl chloride (PVC) liner. The proper QA/QC inspection procedures for installation of the liner will be implemented to ensure the integrity of the welds and liner placement in accordance with landfill construction techniques.

Comment 5. Page 6-5, Section 6.10. The solidifying reagents, WLPM and LKD, should also be stored and handled appropriately. As mentioned above, LKD mixed with water creates a pH 12.4 solution at saturation that would have to be collected and possibly treated prior to disposal.

Response 5. Comment noted WLPM will be utilized, if needed, during the construction activities and will be properly stored and handled.

Comment 6. Page 7-4, Section 7.2.6. Although the text refers to Figure 1-2 for the "sediment stockpile area," this area is not labeled on the figure.

Response 6. Comment noted. The text will be revised to refer to Drawing C-1 of Appendix I

Tables

Comment 7. Table 4-1. This table provides helpful information, particularly with respect to ARARs compliance. However, it should be revised to reflect the fact that the California Clapper Rail, California Least Tern, California Brown Pelican, and salt marsh harvest mouse are listed as endangered under both Federal and State ESAs.

Response 7. Comment noted. Table 4-1 will be revised to reflect Federal and State ESA status.

Figures

Comment 8. Figure 1-2. The boundaries of Site 27 should be clearly labeled on this map. In addition, features depicted here would be more clear if appropriate colors and principles of basic cartography were used. For example, the very faint dots could be changed to blue for water and water depths could be indicated by using buffer features of the mapping software.

Response 8. Comment noted. The Site 27 boundaries are shown on Drawing T-1 and the limits of work are shown on Drawing C-2 of Appendix I. Reference to the two figures will be added to the text.

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Appendix B, Stormwater Management Plan

Comment 9. Figures B.1-2, B.4-1. The figures here do not clearly depict the erosion control measures that are described in the text of the report. The figures should be referenced with the related design drawings in Appendix I.

Response 9. Comment noted. Figure B-1-2 is a Site Plan and Figure B-4-1, equivalent to design drawing C-3 of Appendix I, is the erosion control plan and illustrates erosion control measures based on the Best Management Practices listed in the Construction Handbook and referenced in the SWMP such as sediment detention basin (ESC056), stabilized construction entrance (ESC 023 & ESC 024), silt fence (ESC 50), turbidity curtains (listed with other BMPs) and gravel access roads (ESC 023 & ESC 024).

Comment 10. Page B.2-2, Section 2.2. The location and amount of the indicated plant communities should be specified and mapped, if possible. This would help provide a basis for a restoration plan and other project elements.

Response 10. Vegetation mapping will occur during the site visit with representatives from DFG, FWS, landowners, etc. This site visit will be scheduled in January 2006.

Comment 11. Page B.3-2, Task 3. Elements of aquatic and riparian restoration construction activities that are mentioned here should be described in detail in the Draft Final RD. At a minimum, these elements should include types of plants, time of year of plantings, irrigation, and other details. Maintenance of water quality in the channels should also be a consideration. A site visit involving representatives of the DFG, U.S. Fish and Wildlife Service, the current landowner, and others would be useful for developing such a plan. Habitat restoration options at the three excavated channels might include plantings of willows, cottonwoods, or other plants. Such options should be consistent with habitat restoration plans for areas to the north, especially at the Cargill or Sunnyvale ponds.

Response 11. The following will be conducted by the Navy:

- Obtain Cargill and Sunnyvale ponds habitat restoration plans for reference use
- Site visit with representatives from DFG, FWS, landowners, etc.
- Generate a habitat restoration plan

Obtain approval from the respective authorities prior to restoration activities

Comment 12. Page B.3-3, Task 4. With respect to the habitat restoration plan, see Comment 11 above.

Response 12. Refer to Response 11

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Comment 13. Page B. 5-1. Item 5.0. Consideration should be given to augmenting the Best Management Practices with a requirement for site stabilization at specified intervals prior to or during in the rainy season (October 1 through April 15). This will help to keep sediment from reentering the channels and adversely affecting aquatic life.

Response 13. Comment noted. Refer to Section B-10-1 Inspections “All storm water pollution prevention measures and BMPs will be inspected prior to the rainy season and before (prediction of) and following (measurement of) each rain event greater than or equal to 0.25 inches within 24 hours. The inspection will allow for evaluation of the BMPs implemented to prevent the release of potential pollutants. All inspections shall be performed by trained personnel, and the appropriate forms, provided in [Attachment 2](#), shall be filled out. Any BMP inadequacies shall be recorded, modified, and upgraded or repaired as soon as possible. All completed inspection forms shall be retained in the project files”.

Comment 14. Page B.5-1, Section 5.2. More specificity should be provided as to methods for revegetation (see Comment 11 above).

Response 14. Comment noted. Refer to Response 11

Appendix C, Sampling and Analysis Plan

Comment 15. Page C.2-3, Section 2.1.5. No rationale is provided for a maximum depth of two feet of additional excavation if remedial action objectives (RAOs) are not met in the North Channel or ditches. Additional actions, such as the placement of clean fill, would be needed to prevent exposure to residual contaminated sediment.

Response 15. Section 2.1.5, following sentence will be inserted at the end of paragraph.

In order to maintain the integrity of the channel clay liner, a maximum of two feet of the clay layer will be excavated. If the confirmation sediment sample does not meet the RAOs after two feet of additional excavation, then Navy will be notified since additional excavation may cause infiltration to the channel from adjacent areas. THERE WILL BE NO RESIDUAL CONTAMINATED SOIL.

Comment 16. Page C.2-3, Section 2.1.6. No rationale is provided for a maximum depth of two feet of additional excavation if remedial action objectives (RAOs) are not met in the North Channel berms. Additional actions, such as the placement of clean fill, would be needed to prevent exposure to residual contaminated soil.

Response 16. Section 2.1.6, following sentence will be inserted at the end of paragraph.

In order to maintain the integrity of the channel clay liner, a maximum of two feet of the clay layer will be excavated. If the confirmation sediment sample does not meet the RAOs after two feet of additional excavation, then Navy will be notified. THERE WILL BE NO RESIDUAL CONTAMINATED SOIL.

Comment 17. Page C.2-7, Section 2.2.4. The text should identify whether water samples will be analyzed as unfiltered or filtered prior to analysis.

Response 17. Section 2.2.4, following sentence will be inserted after “...pre-cleaned sample containers.”

Water samples are for waste characterization purpose, samples will be analyzed as unfiltered samples.

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Comment 18. Page C.2-8, Section 2.2.5, and Table C.1-2. The text refers to confirmation samples collected from zero to six inches in the Northern Channel and ditches, whereas the table states the samples will be from zero to 12 inches for these areas. This discrepancy should be resolved.

Response 18. Table C.1-2, Step 4, number 2 first sentence should state:
 2. Confirmation soil samples will be collected from each 50-foot linear section at zero to 6 inches below ground surface for the Northern Channel and ditches along the slopes.
 Step 7, number 2 first sentence should state:
 2. Confirmation soil samples will be collected from zero to 6 inches bgs, as described in Step 4.

Comment 19. Attachment B, Table B-1 (soil/sediment). As mentioned above, the industrial PRGs were developed to protect human workers and their use as the action levels for imported materials is generally not protective of ecological receptors. Furthermore, the industrial PRGs for dichlorodiphenyltrichloroethane (DDT) and its metabolites as total DDTs (24 mg/kg), total polychlorinated biphenyls (PCBs) (0.740 mg/kg for each Aroclor), cadmium (450 mg/kg), lead (800 mg/kg), and zinc (100,000 mg/kg) all exceed their respective Site 27 RAOs. The rationale for using imported soil or clay as backfill that have potentially higher concentrations than the contaminated material that is being excavated is unknown. Therefore, the Site 27 RAOs and ecological benchmarks for the chemicals without RAOs should be used as action levels.

Response 19. Comment noted. Refer to response #2

Comment 20. Attachment B, Table B-1 (water). Analytical results for collected wastewater should also be compared to ambient water quality criteria for aquatic life since subsequent disposal to the Northern Channel is being considered.

Response 20. Excess water resulting from the dewatering of wet sediments will comply with the existing NPDES permit and be sampled for the COCs for Site 27 prior to discharge to the Northern Channel. A filtration system will be used to ensure that the recontamination of the channel does not occur. We will comply with existing NPDES requirements and will include PCBs and DDT analysis as per the regulators request.

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City of Sunnyvale Comments

Comment 1. The discussion of remedial action seems to consistently limit soil excavation to the westernmost 800 feet of the northern channel (see page 2-1 last sentence, page 6-1 first paragraph, pg. C.1-2 second bullet from bottom.) This report does not indicate that there will be any excavation at the east end of the channel. We also are unable to locate anywhere in the design drawings where soil excavation is specified at the east end of the northern channel.

The Final Record of Decision Site 27 Northern Channel, June 24, 2005 (ROD) identified soil concentrations of PCBs above the remediation objective in soil on the southern berm at the west end of the northern channel (referred to in the report as the "Lockheed Berm"). The ROD (and discussions leading up to that document) indicated that "Excavation will extend according to the following limits:Contaminated soil from (1) western end of the Cargill and National Aeronautics and Space Administration berms adjacent to Building 191, and (2) the Lockheed Martin Corporation berm near the eastern end of the Northern Channel" (executive summary, pg X and report page 26.) Based on the discussion in the ROD it is our understanding that excavation will occur in this portion of the berm, e.g. the Lockheed Martin Corporation berm near the eastern end of the Northern Channel. Please edit the Remediation Design Report to include that excavation with specific details of what will be excavated and how. Also, since the soil excavation in this area that is described in the ROD is apparently adjacent to City of Sunnyvale property, please provide documentation that this proposed excavation will not extend onto City of Sunnyvale property.

We understand based on the ROD and the Feasibility Study Report that confirmation sampling will be conducted at or near the Site 27 boundary. We further understand that the Navy has committed to, and is legally required to, conduct additional investigation and remediation if such work is found to be necessary based on the confirmation sampling results. Although not anticipated at the present time, this could potentially include a future phase of additional work beyond the Site 27 boundaries if that were found to be necessary.

Response 1. Comment noted. The text will be revised to reflect the Final ROD to include the excavation on the Lockheed Martin Corporation Berm near the eastern end of the Northern Channel. The extent of remediation is limited to Site 27 as identified in the ROD and will not extend onto the City of Sunnyvale property.

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Comment 2. The draft Remediation Design Report does not include the remediation objectives that were selected for soil. In the ROD it is stated that the EPA's Residential Preliminary Remediation Goals (PRGs) are to be used as remediation goals for soil excavation on the slopes and top of the berms, and a table of those values is listed for the chemicals of ecological concern at this site. However, the Remediation Design Report refers only to the remediation goals that were developed and proposed for the sediment, and specified in the ROD for sediment only. The Remediation Design Report should be edited to include the PRGs for soil and to specify clearly where each set of remediation goals will be applied.

Response 2. Comment noted. The text will be revised to include both the RAOs for the soil and the sediment.

Comment 3. Given the above, it may be preferable as a general approach to add a separate section to the Remediation Design that addresses the soil remediation, with a separate discussion, drawings, and if appropriate also separate specifications.

Response 3. Comment noted. The Navy will continue with the same document format, incorporating comments where feasible.

Comment 4. It is our opinion that descriptions of location of contamination, excavation and sampling should be made consistent and un-ambiguous, and the use of terms like "on the Lockheed berm" should be avoided. If the intention is to identify the west end of the southern berm of the northern channel at a specified distance from the west end, then that needs to be stated specifically. Alternatively, the terms "Lockheed berm" and "NASA berm" could be defined at the beginning and then used consistently. As written these terms are not specific and add confusion.

Response 4. Comment noted. The terms used were already in the FS and ROD.